Engineering and Mining Journal

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AUGUST 11, 1917

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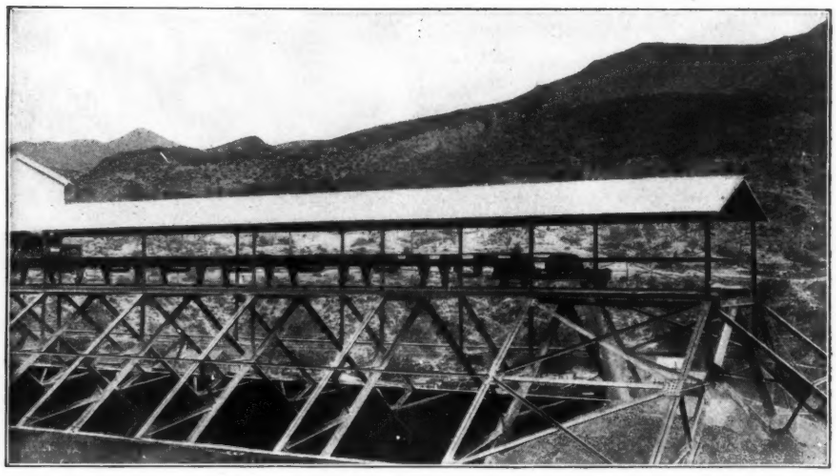

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A Steel Headframe in Ecuador

BY W. A. WOLF AND T. L. CHAPMAN*

The South American Development Co. has erected a 90-ft. headframe at its Zaruma mines in Ecuador, South America. The mines are three days by muleback from river transportation during the dry season, when the trails are in comparatively fair condition; during the six months of rain but little freight is carried, the trails being almost impassable. All material is transferred to river boats at Puerto Bolivar, the nearest port, about 100 miles south of Guayaquil. Small river steamers make the trip up the river in from six to twelve hours.

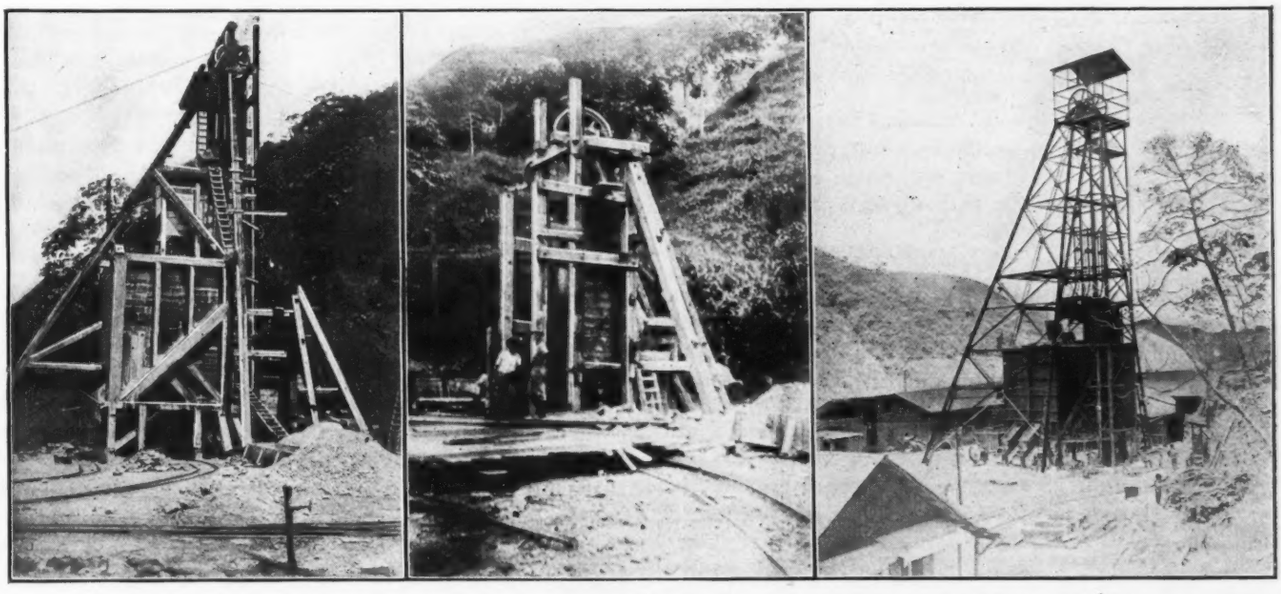
THE headframe is of the "A" type, with two sheaves for hoisting in counterbalance, the distance from the collar of the shaft to the sheaves and to the peak of the roof being 80 ft. 6 in. and 92 ft. respectively. The distance from the center of the two-compartment shaft to the center of the hoisting drum is 92 ft. 6 in.

The steel framework, supplied by the Lackawanna Bridge Co., was designed for a working load of approximately 16,000 lb. and consists of the 80-cu.ft. skip with its load of four tons, the cage and 1000 ft. of 1-in. rope. The resultant of the stresses in the hoisting rope falls two feet within the center plane of the back braces.

A general view of the structure is shown in the accompanying drawing with the horizontal cross-bracing part of the ore bin and minor details omitted. The steel is medium steel supplied under "Manufacturers' Standard" specifications. The members were painted with two coats of Detroit graphite at the shop and one coat of red graphite after erection. The steel is not subjected to warm moist mine air, as the shaft is downcast.

The main front columns and back braces, excepting the lower sections, are of two built-up 6 x 6 x $\frac{3}{8}$-in. angles. In the lower panel they are made-up sections of two 6 x 6 x $\frac{3}{8}$-in. angles and two 4 x 3 x $\frac{1}{4}$-in. angles with $\frac{1}{4}$ x 2-in. lacing bars.

The sheaves, carried on plate diaphragms, with their center line parallel to the center line of the back bracing, are 7 ft. in diameter and carry a 1-in. plow-steel hoisting rope. Each sheave is sectionalized, consisting of 14 parts—6 spokes, 6 rim segments and 2 hub sections. The total weight of each sheave, including the 6-in. shafting to which it is keyed, is 2209 lb. The sheave platform is wood-covered and has a wooden handrailing. An iron ladder attached along the center line of the diagonal back bracing runs from the ground to



Old Headframe Temporary Headframe New Headframe

HEADFRAMES AT ZARUMA MINES, ECUADOR, S. A.

*Guayaquil, Ecuador, S. A.

the sheave platform. The guides, in front of the plane of the main columns, are of hardwood indigenous to the country and are the same as are used in the shaft.

The self-dumping, four-ton, Kimberley-type skip, of the usual design, is of ¼-in. plate with additional wearing plates and is suspended beneath the cage. The cage is inclosed and fitted with gates and safety dogs. The cage and skip combined weigh 5750 lb. A Wellman-Seaver-Morgan safety detaching hook is also provided. The cage, skip and sheaves were built by the Allis-Chalmers Company.

The hopper-type ore bin, wood-lined and faced with ¼-in. steel wearing plates, has a capacity of 200 tons. It is divided into two compartments by a hinged door. At present one side is for ore and the other for waste.

Muleback is the only means of transportation. This and the condition of the trails prohibit shipping material in heavy pieces or in long lengths.

The structural steel, total weight of 108,688 lb., was shipped in 2337 pieces, packed into 410 bundles, the heaviest piece weighing 210 lb. The longest piece was nine feet in length. Rivets, bolts, corrugated iron, etc., made an additional 150 packages. The costs of the headframe, including cages, skips and sheaves, from manufacturers to destination at the mines, are shown in the table.

COST OF THE HEADFRAME

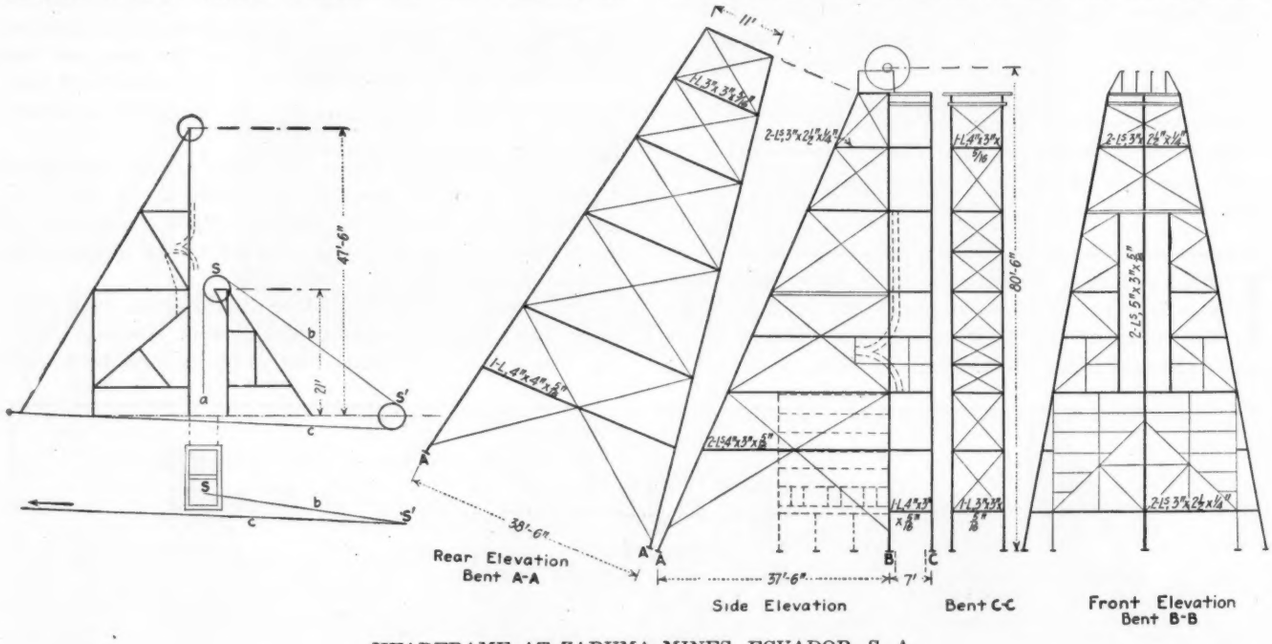
F. O. B. New York	$6,607.87
Ocean freight	1,143.42
Port charges at Puerto Bolivar	793.89
River steamer and transfer	134.04
Muleback transport	1,755.62
Total	$10,434.84

All ore for the mill and waste rock from the mine are hoisted through the one shaft. The old headframe was torn out and replaced by the steel structure without interruption to hoisting or interfering greatly with the regular mine work. This was accomplished by the use of a small temporary headframe built on the opposite side of the shaft.

The old frame was a wooden structure of the "A" type, 47 ft. 6 in. in height, the front legs, back and side braces being of timber built up by nailing and bolting 2-in. plank together. The combined capacity of the ore and waste bins was about 80 tons. Rock was hoisted in a 20-cu.ft. self-dumping skip with a ¾-in. steel hoisting rope passing over a sheave 48 in. in diameter.

The work preliminary to the erection of the steel was effected by concreting the upper part of the shaft, erecting the temporary headframe, razing the old headframe and concreting foundations for the new headframe.

It was decided to concrete the shaft to a depth of 25 ft. below the surface, the ground around the collar being loose. From a depth of 25 to 50 ft. the ground was firm, the space between the lagging of the shaft sets and the ground being filled with loose rock. This section was relagged with 2-in. hardwood lagging and a cement grout, one of cement to ten of sand, forced in by gravity to bind this loose rock. After the completion of the grouting, the ground around the shaft was excavated to a depth of 25 ft., or to the top of the grouting, a heavy truss first having been placed to support the front legs and the front posts of the old headframe



HEADFRAME AT ZARUMA MINES, ECUADOR, S. A.

and its ore bin, as on excavating the ground was taken from under these members. The ground being loose, spiling was necessary. The shaft sets were well braced.

The base of the concrete walls around the shaft was made 4 ft. wide and sloped in to 8 in. except at the front corners and the back center, the concrete at these points being made 2 ft. thick as they are foundation points for three of the members of the steel structure. Board

COST OF CONCRETE GROUTING

	Supplies	Labor
Cement	$785.18	
Hardware	68.28	
Timber	229.16	
Excavations		96.00
Lagging		123.14
Forms		192.19
Mixing and pouring		382.56
Machine shop		14.98
Carpenter shop		25.95
Total	$1,082.62	$834.82
Total, supplies and labor		$1,917.44

forms secured to the shaft timbers were used only on the inside of the walls, a rock wall being built for the back form as the concreting advanced. A 1:3:6 mixture was used. The walls were reinforced with No. 7

triangular mesh and ¾-in. twisted bars. Filling of the excavation back of the rock wall with broken rock and dirt, dampened and tightly tamped, was also carried along with the concrete. Grouting the shaft and concrete for the collar required 257 sacks of cement. Costs of relagging, grouting and concreting were as given in the accompanying table. Cost of obtaining sand and rock is included in the table.

The Temporary Headframe

The temporary frame, 21 ft. in height and placed on the opposite side of the shaft, was made sufficiently high for the skip to dump directly into a car, a short lip between the dumping plates being all that was necessary. The front legs, side and back bracing were built-up 7 x 10-in. timber made of 2 x 7-in. plank nailed and bolted together.

The hoisting rope was carried almost horizontally on rollers from the drum to an auxiliary sheave placed on the opposite side and 24 ft. beyond the center of the shaft and to one side of a line through the center of the drum and the center of the hoisting compartment, so that the cable carried horizontally would clear the shaft collar. Positions of the headframes and the auxiliary sheave are shown in the illustration, the head sheave being in the plane of the rope *aSb*, the auxiliary sheave in the plane of the rope *bS'c*.

In changing from the old to the temporary frame the only hoisting time lost, about one hour, was in lowering the head sheave from the old to the temporary frame and placing the cable in its new position. The total cost of the temporary structure was $619.96, of which $197.79 was for supplies, mainly timber, and $422.16 for labor.

Removing the Old Headframe

The razing of the old frame was without incident. Several days were required as it was taken down in sections. The shaft opening was carefully housed to prevent objects from falling into the shaft. Excavating, building of forms and the mixing and pouring of concrete for the foundations of the steelwork followed the removal of the débris of the old frame.

Excavations for the foundations were made to a depth of about 3 ft. 6 in. The forms were brought up about 1 ft. 6 in. above the surface of the ground, the shaft collar having been raised that amount. The total area of the base of the foundations approximates 400 sq.ft. exclusive of the shaft collar. The foundations contain about 1200 cu.ft. of concrete, which required 192 sacks of cement, using a 1:3:6 mixture, the volume being augmented by the addition of large rock to the base of the foundations.

COST OF THE FOUNDATIONS

	Supplies	Labor
Excavations	$0.89	$98.08
Cement	586.60	
Forms	92.11	65.43
Mixing and pouring		163.38
Foreman		85.80
Total	$679.60	$412.69
Total supplies and labor		$1,092.29

Erection of the steel followed the completion of the foundations, as many sections as could be readily handled having previously been assembled and riveted on the ground. Sections 15 to 25 ft. long, weighing up to 1000 lb., were built up and riveted on the ground. For swinging the steel to position a 50-ft. gin pole was used, the pole being raised and lashed to the steel in place as the work progressed. All hoisting of steel was done by hand with block and tackle. During erection the parts were bolted, riveting being done above ground only after the frame was completely assembled. Over 12,000 rivets were used on the frame; about 1600 were shop-driven, and about 5000 were driven on the ground previous to erection, the remainder being driven after all the steel was in position. All riveting was done with pneumatic hammers.

The steel was placed and bolted in position in 37 working days. Two months were spent in replacing the bolts with rivets, lining the ore bin, building chutes and placing the sheaves. The temporary headframe, which had been in use for 4½ months, was removed; three shaft sets at the collar were taken out and replaced by two; the last of the steel, which could not be placed until after the removal of the temporary frame, was riveted into place, and the hoisting rope and skip were changed. Hoisting was interrupted by this work for only 17 hours. The first skip load of rock was hoisted, using the new structure, on Oct. 6, 1916.

The cost of assembling and erecting of the steel frame was as shown in the tables.

COST OF ERECTING THE HEADFRAME

	Supplies	Labor
Assembling	$261.51	$738.27
Erecting	973.65	2,742.16
Painting	118.07	38.40
Wiring	13.50	16.32
Lining ore bins	703.44	201.15
Supervision		657.79
Total	$2,070.17	$4,394.09
Total, labor and supplies		$6,464.26

In the last table all costs are included from the commencement of the preliminary work in the shaft to the completion of the structure.

TOTAL COST OF THE HEADFRAME

	Supplies	Labor
Shaft collar	$1,082.63	$834.83
Temporary headframe	197.79	422.16
Foundations	679.61	412.68
Assembling and erection	2,070.17	4,394.08
Total	$4,030.20	$6,063.75
Total, labor and supplies		$10,093.95

All work except the assembling and erection of the steel, which was under the supervision of John Paul, master mechanic, was directed and supervised by the mine staff.

Canadian Research

The activity of the Canadian Research Council is described by its chairman, Prof. A. B. McCallum, in an interview appearing in a recent issue of the *Canadian Engineer*. The chief problem before the council is that of making lignites economically usable. In some countries this is done by carbonizing and briquetting with tar or pitch. But lignites vary so greatly in composition that a treatment that is useful with one may be worthless with another.

The council is also considering the practicability of using the tar sands of Alberta as road material. Other subjects of research are reforestation and the production of phosphates and potash. The German supply of the latter being cut off, feldspar is being looked to as a possible source, though no means of utilizing it have as yet been discovered.

The fixation of atmospheric nitrogen for the manufacture of nitric acid and ammonia is being studied at the request of the Imperial Munitions Board.

Observations on Sinking Pumps

By J. F. KELLOCK BROWN*

From a varied experience in the use of sinking pumps the author points out some of the shortcomings in their design. The subject is treated entirely from the viewpoint of the user of sinking pumps. It might be impossible to design a pump to overcome all the objections mentioned, but several pertinent suggestions and remedies are given.

THE following notes are the outcome of considerable practical experience with many sinking pumps operated under a variety of conditions. They are written from the viewpoint of the man who has had to handle this class of plant on the ground, and for that reason they will in all probability not be gratifying to the pump maker. There may be all sorts of mechanical disadvantages in connection with some of the ideas brought forward, but I have hardly ever handled a sinking pump without wishing that I had a pump designer standing in the pouring wet shaft beside me.

There are undoubtedly many sinking pumps that are excellent machines mechanically; that is, under ideal conditions, they do their work with satisfaction and some perfection, but put to the test under adverse conditions, which usually appear in shaft-sinking work, where water is troublesome and the going bad, there nearly always appears about the pump some point that is capable of improvement. In other words, it would seem that designers have paid sufficient attention to the proper design of the pump itself, but not enough to the general conditions under which it has to work.

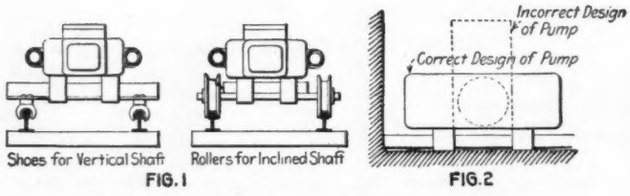


FIG. 1 FIG. 2

ARRANGEMENTS FOR PUMPS IN SHAFTS

First, consider the handling of the pump in vertical shaft-sinking, in which heavy water is encountered, and which may not or not require heavy timber. Getting a small sinking pump down a shaft of this type is an operation that absorbs the energies of the entire force. The pump has to be hauled over the ground on skids, lifted by main force upon the platform at the shaft collar and the hoisting rope attached. If the hoist is too small for the work, trouble begins with the failure to lift the pump. Perhaps the hoistman thinks he will take a running jump at it, so he gets a good head of steam, uses a little slack, and does enough to jerk one end of the pump off the platform. This more than likely causes it to swing round suddenly and erratically; everybody gets out of the way to avoid smashed feet, and the pump swings with a jerk and a jar on the rope, into the shaft, while congratulations are rife if no further damage is done, which would be a miracle. Should the pump, however, prove too heavy for the hoist, the work is at a standstill until someone takes a 40-mile journey out to the nearest station and waits there a week for a single block of sufficient size to take the hoisting rope without damaging it through bending round too small a radius. Makers of course contend that the provision of such a block for an emergency of this nature has nothing to do with the design of the pump. To this contention I agree, but I might add that it would aid their sales if they would confer with their customers and find out the conditions under which the pump is to be used, the size of the hoist, and if too small, recommend and provide such a block ready made to assist in the work, thus ensuring good results.

Difficulties in Getting the Pump Down the Shaft

Having raised the pump either by sheer lift or by dividing the load between the headframe and the hoist, it is swung clear in the shaft, swaying about from side to side. All parties make a grab at it to steady it, and one man is saved from falling down the shaft by the slack of his pants. Down it goes slowly, while a few of the more venturesome follow it cautiously down the ladderway. If the shaft is sunk at a slight inclination, one corner of the pump sooner or later catches on the walls, and the pump rolls over and smashes part of the ladderway, if it does nothing else. The damage having been repaired, pinch bars are brought down to roll the pump over again. Some engineer who passed his examinations in brilliant style, in order to get what he thinks is a good leverage, inserts the end of his bar between the pump casing, or waist piece, and the piston rod. Not quite satisfied with the power he is exerting, he sits down on the ladderway and shoves with his feet against the end of the bar. United energy turns the pump, and the aforesaid engineer sustains an unexpected descent and is only rescued by quick work on the part of someone else. In the resultant effort the pump rolls completely over the other way, and the outstanding pinch bar takes another workman below the knee, laming him for a week. On perhaps the third attempt in the confined space, the pump rights itself and an examination in the half-light available discloses the fact that the piston rod looks somewhat the worse for usage, and the pump has to go to the surface for overhauling, which cannot be done in the shaft. And so the work goes on with a great waste of time and expenditure of effort, partly through ignorant labor and lack of proper directive knowledge, but mainly because there is no simple, easy system of getting sinking pumps up and down a shaft. These pumps have to be taken up and sent down many times because there is something wrong with them, and although the labor force improves with practice, the operation of hoisting and lowering is always troublesome and often dangerous.

*137 McGill St., Montreal, Que., Canada.

Some makers think they provide against the cause of these difficulties by supplying skids beneath the pump. They are made of wood, however, and the effort expended in trying to overcome the friction of wet wood-slides against wet wooden barring or close timbering that is not exactly flush is greater than any advantage that is gained. There is also little benefit, except that it protects the under side of the pump where there are rock walls whose projections would otherwise catch first one side and then the other, causing the pump to tilt easily and roll over. In a vertical shaft these troubles are not so great, but the dangers from swinging and twisting are increased.

Runways Should be Provided

To overcome these difficulties, is it not possible for pump makers to provide a simple runway of small rails, built in short sections capable of being extended and driven into position by a wedge? On this would run a rectangular carriage bolted to the pump, the gage being wider than the pump. Before taking down the pump, this runway would be spiked to the timbers and a length left below, projecting into the water. On being raised, the carriage and the pump attached to it would be placed on this runway, and it could then be slowly and steadily slid into position. As the carriage would be broader than the pump, there would be no tendency to overturn. In this manner a sinking pump could be raised and lowered with a maximum of ease and without a great waste of time. In the vertical, or nearly vertical, shaft the small wheels of the carriage could be replaced by guide shoes, as shown in Fig. 1. The slight sacrifice made in space, which need not be more than a few inches, is more than offset by the greater ease in handling. There is no disputing the fact that a sinking pump has to be raised and lowered in shaft work from a variety of causes—in firing shots, for breakdowns, changing suction hose, changing pipes, timbering—and in a confined space with a constant stream of water pouring down, the slowness of the work is exasperating. Pump makers have eliminated a great many of the troubles of faulty design of the past, and if they would now turn their attention to the provision of some easy means of raising and lowering, many mining men would be thankful.

Perhaps the next point that calls for consideration is the shape and balance of the pump. By shape, is meant the relation of the width of the base and the depth through the pump. To get easy handling, the base should be greater than the depth at any section of the pump, as shown in Fig. 2. If this is not the case, the pump is easily tilted and rolled over. There are a few sinking pumps on the market that are irregular in this respect, some part or other jutting out beyond the line of the center of gravity, causing the pump to be more susceptible to twisting and rolling over to that side. A pump with a broad base means stability and is not so dangerous to handle.

All Openings Should be on One Side of the Pump

This brings us to other points in the design of sinking pumps. Every door, and every set of bolts on the pump, holding the door of the water chest and of the steam and valve chest, should be on the side of the pump toward the center of the shaft. A pump so built that the water door faces one way and the steam chest another way, at right angles to it, is storing up trouble for itself as soon as conditions require the pump to go into a corner of the shaft. A pump of this awkward design must be shifted from its position every time something has to be examined inside or the valves cleaned. Moreover, it is easier to have a man who has to stand on awkward footing, work at bolt heads in front of him rather than stretch around corners after them.

The next point concerns the pipe connections for inlets and outlets. These commonly are placed at right angles to the length of the pump. This arrangement not only causes an abrupt right angle bend, but also gives rise to troubles from another source. In order to minimize time lost in the shaft and to do as much work as possible on the surface where conditions are more favorable, short lengths of pipe or nipples of the proper size are inserted in the exhaust, steam, and discharge outlets, before the pump goes down. But in lowering the pump these nipples are often broken off within the thread of the casing, which causes much trouble in taking the broken parts out. The alternative of putting together these nipples, elbows, and unions (all from awkward position in the shaft) is a slow and troublesome task. Unless the men are familiar with the work, it necessitates much running up and down to get the proper sizes, loss of others in the sump below, perhaps accompanied by some wrenches that can ill be spared. There is surely no mechanical objections to designing a pump in such a manner that the pipes enter and leave parallel with the length of the pump. This would not only make the pump easier to handle in itself, but it would also facilitate the attachment of the pipe lengths. Again, is there not such a thing as a good reliable tight swivel joint that could be profitably used on all these pipe lines and placed on the pump on the top of the short entrance piece? As already stated, the pump and the piping cannot always be maintained in a parallel line, and it is always difficult to make the pipes come near to their proper positions on the pump. A joint that would permit play at this point would tend to make the handling of the sinking pump quicker. Unless one has stood in a shaft in which the water is rising steadily and fast, he cannot appreciate how anything that would aid speedy work is to be so desired.

Put Folding Steps on the Bottom of the Pump

A sinking pump is usually placed in a corner out of the way of the ladder and bucket run. This may require a staging over to the pump on which a man can stand while working. Usually when a breakdown does occur, it is found that this has yet to be done, and all the time the staging is being built the water is rising and driving the men away from their work. Is it not possible to have two folding steps attached to the foot of the pump. On which a timberman or pumpman could stand, as shown in Fig. 3. If in addition he had a strap passed round his waist and hooked to some part of the pump or to some special hook provided on the pump, he would be in the most natural position to work at the most troublesome part of the pump (the water chest), would have both his hand free and would be independent of a staging that

would have to be put in every time the pump was lowered.

The rods by which a sinking pump is suspended should be adjustable, so that the pump may hang vertically or be made to lean either in or out at the foot as required, as shown in Fig. 4. There are many occasions when a pump that hangs away from the shaft wall at the bottom is much easier to get into position than one that is apt to dig its nose into every spike and rock projection on the way down. There should be little difficulty about this.

Use Common Bolts and Nuts Instead of Stud-Bolts

Then there arises the question of stud-bolts versus common bolts and nuts, and despite difficulties of design and the additional weight that has to be added to get this, the common bolts are preferable. Everyone knows the condition of the pump which has its water-chest cover or steam-chest cover held in position by two stud bolts while the rest have worked loose or been broken off short. A pumpman working with such a machine faces disaster every day, because there is no way of remedying the trouble except by sending the whole pump, or half of it, to the nearest machine shop, often many miles away. If common bolts had been used, it would have been easy to stock a few sizes and replace them when broken or lost down the shaft. The use of stud and common bolts are shown on the right of Fig. 3. These same reasons make it advisable to have the nuts, single or double, holding the plunger to the continuation of the connecting-rod and the piston to the piston rod, replaced by keys. Nuts strip under hard usage, get lost and cannot be replaced or made on the ground, while at a pinch a key can be made that will temporarily answer the purpose.

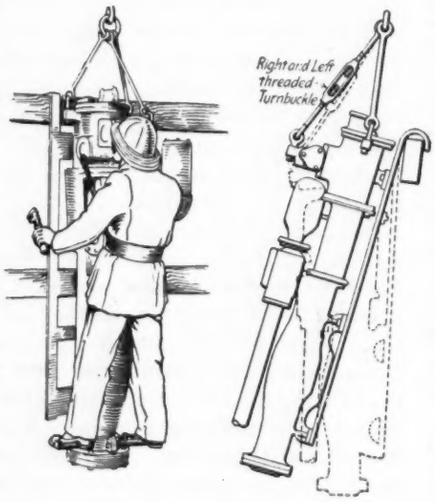


FIG. 3. SINKING-PUMP INSTALLATION

A plunger should not be threaded to the piston-rod continuation, but it should pass through the plunger. This has to be a water-tight connection or some day the plunger will be found split from a "freeze." The piston, piston rod and plunger must pull through the pump when the top cover is removed, and if designers would set their wits to devising means whereby some hold could be got on this piston and the rod, at the top, so that it could be hoisted from the pump if need be, they would be doing a favor to pumpmen. Such an arrangement would be a great deal better than the present practice of having a man driving the ram end with a billet of wood and a sledge hammer.

Pumps that are all arms and legs, levers and projecting arms are not suited for shaft work. These things get smashed, bent and broken too easily, but at the same time some arrangement of a bypass from discharge column to suction column is certainly handy. On the discharge column a valve immediately above the pump—a clack valve which will hold up the column of water—is useful, but it would be more useful still if some of the water in the discharge column could be utilized for flushing the water chamber and its valves under proper regulation.

Have Openings Large Enough to Get Hands In

One sometimes wonders why it is that pump makers make the entrance to the water chest and the steam chest, or the steam-valve chest, so small that a man's hand can't get properly inside. This is especially true of the valve chamber in the water chest, which is apparently designed to admit a small, ladylike hand and not that of an average burly miner, who is lucky if he can get two fingers through with which to extract a piece of rock or other foreign matter that is interfering with the proper working of the pump.

The question of screwed-in valve seats compared with pressed-in and keyed seats is perhaps more for the designer to settle than the pump user, but the viewpoint of the man who has to run the pump should not be ignored. In general, seats that are pressed in are more easily removed, replaced, and in case of great necessity temporarily repaired by crude appliances on the site of the actual work, than is the screwed seat. Owing to rusting and other water effects, a threaded seat has most frequently to be cut out with hammer and chisel, an operation which under careless hands may destroy the corresponding thread in the casing and result in the whole pump being sent to the shop, to get rebored and rethreaded and finally ending up with valve seats of assorted sizes.

No doubt pump makers will despise these suggestions as being crude and at variance with good mechanical design and as being the cry of a crank on sinking pumps. But before they are finally dismissed one way or the other, let it be said that they are the results of some bitterly gained experience, of much standing in rubber boots on the water chest of the pumps, in oilskins and hat, with a hot steam exhaust enveloping the pump, and operating under conditions where to make any headway on the water, the change from an upper lift to a lower one had to be made at lightning speed.

Spanish Mineral Exports

Exports of metals and minerals from Spain for the quarter ended Mar. 31 are reported by the "Revista Minera" as below, in metric tons:

	Metals		Ores	
	1916	1917	1916	1917
Iron	21,569	29,005	1,117,133	1,152,302
Copper	4,316	3,997	14,717	3,172
Copper precipitate	3,026	2,825	.....	.....
Lead	42,927	35,448	956	56
Zinc	1,122	202	28,532	5,663
Manganese	.....	.....	216	1,945
Quicksilver	417	.....	.....	.....
Pyrites	.....	.....	837,012	486,312

Iron exports include pig and manufactured iron and steel. Exports of salt were 86,917 tons in 1916 and 75,198 tons in 1917. Imports of coal were 479,729 tons, an increase of 26,790 tons; of coke, 24,826 tons, a decrease of 14,021 tons.

Metallurgy of Ferrochromium*

Ferrochromium in steel manufacture increases the tensile strength of the steel when added in small amounts. Chromium-bearing steels are harder than ordinary steels. Chrome steels are used in armor plate and in making armor-piercing projectiles. The manufacture and use of the alloy is described.

FERROCHROMIUM, like ferrosilicon, was one of the pioneer alloys made in the electric furnace at the time when this appliance was first used for the manufacture of ferro-products. As in the metallurgy of other ferroalloys, the technique of ferrochromium manufacture gradually has been improved. As an electric-furnace product, ferrochromium is second to ferrosilicon from the standpoint of tonnage.

Prior to the introduction of the high-temperature electric-melting furnace, the manufacture of ferrochromium was performed almost entirely in the blast-furnace stack, although a smaller amount was made in the crucible. Crucible manufacture gives high-tenor alloys, but several concomitant disadvantages are present. Only small charges can be fired at a time; the crucible cost is high, as special and expensive pots are required; and the alloys, though rich in chromium, are also comparatively high in impurities. The product is, therefore, not always satisfactory. For commercial purposes the electric furnace affords satisfactory appliance in which alloys high in chromium tenor and low in impurities can be smelted. The large quantities demanded in steel metallurgy for chromium steel production are now made by the electric furnace in the United States, Germany and elsewhere. Various double carbides of chromium and iron have been isolated by different investigators; these double carbides consist of Cr_3C_2 and Fe_3C in varying proportions. The carbide, $Fe_3C.3Cr_3C_2$ was isolated by Carnot and Goutal from a ferrochromium alloy analyzing 59% chromium and 9% carbon, according to Leon Guillet. The same workers showed the presence of the double carbide $3Fe_3C.Cr_3C_2$ in a chromium-bearing steel containing 2% chromium and from 0.5 to 2% carbon. Moissan produced the chromium carbide Cr_3C_2 in his electric-furnace experiments. According to F. Robin, Williams made $3Fe_3C.2Cr_3C_2$ in the electric furnace.

The Modern Ferrochromium

The modern ferrochromium is a high-percentage alloy, containing 60% chromium or more, and the physical properties are directly a function of the amount of carbon present. Thus, as regards color, ferrochromium containing 0.5% carbon is bright gray in color, not unlike lead in appearance, while that with 2.5% carbon resembles aluminum, and an alloy containing 5.5% carbon resembles gray iron in color. Ferrochromiums containing less than 5.5% carbon are magnetic, the magnetism varying with the carbon content; while alloys containing 7.5 and 9% carbon are nonmagnetic, according to Keeney.

It is not an uncommon occurrence to hear of cases of disintegration in shipments of ferrochromiums, as with ferrosilicons, but to date no evidence of accidents, either fatal or otherwise, in connection with the evolution of gases from ferrochromiums have been reported. As far as I know, ferrosilicon is the only ferroalloy that exhibits the phenomenon of giving off noxious and poisonous gases. It has been claimed that the presence of an excess of aluminum in ferrochromium will give rise to a tendency to a spontaneous disintegration accompanied by the evolution of phosphine, PH_3. In June, 1910, Copeman, in England, reported that samples of a consignment of ferrochromium from France had disintegrated, evolving an "acetylene-smelling" gas. The samples disintegrated upon exposure to air and moisture, and apparently gave off large quantities of phosphine. However, this shipment had an unusually large percentage of silicon present, and this fact was supposed to be the cause of the crumbling of the material and the concomitant gas evolution. Prior to 1899, or at the time when the electric furnace came into use, ferrochromium was made either in the blast furnace or in crucible pots. Up to the present time it has been made in crucibles, blast furnaces, electric furnaces and by the Goldschmidt thermit process. The latter process can give a carbon-free product of high purity, showing 98 to 99% chromium on analysis. Neumann, Moissan, Keeney and others experimented in the production of ferrochromium by the electric-furnace process, and the results of the latter have been set forth in several writings in current technology.

TABLE I. ANALYSES OF FERROCHROMIUMS

Kind of Alloy	Elements in % Cr	Fe	C	Si	Al	Mn	Ca	S	P
Blast furnace..	30.00 to 40.00	.....	6.00 to 12.00	....	....	....	....	.....	.....
Blast furnace..	41.39	.....	7.12	0.21	.....	1.84	....	.....	0.052
Crucible.....	19.80	.....	3.80	....	....	0.33	....	.....	.....
Electric furnace	54.50	22.00	9.50	2.25	0.80	0.15	0.25	0.04	0.03
Electric furnace	60.90	31.60	6.10	1.10	....	....	....	....	....
Electric furnace	63.50	35.00	0.60	0.20	0.10	0.10	0.35	0.03	0.02
Electric furnace	63.50	21.50	7.50	5.80	0.80	0.15	0.25	0.04	0.03
Electric furnace	64.00	28.50	5.50	0.40	0.50	0.15	0.25	0.04	0.03
Electric furnace	64.00	31.00	3.50	0.30	0.40	0.15	0.30	0.04	0.02
Electric furnace	64.50	22.00	9.50	2.25	0.80	0.15	0.25	0.04	0.03
Electric furnace	68.24	..	1.00	1.85	0.50	....	....	....	....
Electric furnace	70.96	23.23	5.21	0.50	....	....	....	0.078	0.008
Electric furnace	96.00 to 98.00	2.00 to 3.00	0.75 to 1.25	0.05 to 0.75	....	....	....	.....	...

Electric Furnace Usually Used

Only a small amount of ferrochromium is made in the blast furnace at the present writing for the reason that the electric furnace is more efficient, where the power cost is low; and further, the electric furnace turns out a better product. When ferrochromium is made in the blast furnace, it requires a heavy fuel consumption for its successful manufacture. About three tons of fuel per ton of the 40% alloy are used. The blast furnace product is normally rather high in combined carbon and may contain sulphur. According to Keeney, theoretically, it should be possible to secure a ferrochromium containing 65% chromium from a chromiferous ore containing 60% Cr_2O_3 and 20% FeO, but usually the result is an alloy analyzing about 30 to 40% chromium and 6 to 12% carbon. The modern

*An article by Robert J. Anderson in "Iron Trade Review," July 12, 1917, reprinted by courtesy of the publishers.

method of making ferrochromium then, as already stated, is in the electric furnace, although a lesser quantity is produced by the thermit method.

Generally speaking, the iron-chromium alloy produced in the electric furnace analyzes about 60 to 65% chromium and from 5 to 9% carbon. This product may receive a subsequent refining and decarburization on treatment, which gives a low-carbon alloy. Analyses of ferrochromiums are given in Table I. As may be noted, the impurities in the electric furnace alloys are normally quite low; the carbon may vary from 0.60 to 9.50%, dependent on the amount of this element desired in the alloy.

Where Chromite Is Found

The raw materials used in chromitic smelting are chromiferous iron ore, or chromite, and anthracite coal, coke or charcoal as a reducing agent. Chromiferous iron ores from Canada, Cuba, Turkey, New Caledonia, New South Wales and California have been used in smelting. The only commercially important ore of chromium is chromite, $FeCr_2O_4$. The ore is widely distributed in the United States, being found particularly in California, in Monterey and Santa Clara Counties; in Maryland, near Baltimore in the Bare Hills; and in Massachusetts, North Carolina, Pennsylvania and Wyoming. Almost the entire production in the United States since 1880 has come from California. The ore is mined also at Brusa, in Asia Minor, about 60 miles from Constantinople; in New Caledonia and in the Urals. Canada has turned out increased tonnages in late years; ore is found at Bolton and Ham, Quebec. Chromite occurs in basic igneous rocks like gabbros and peridotites, particularly those containing olivine; these rocks readily decompose to serpentine, so that much chromite is taken from serpentic rocks. Typical analysis of chromiferous iron ores used for smelting are given in Table II.

TABLE II. ANALYSES OF CHROMIFEROUS ORES

	Percentage Composition									
Kind of Ore	Cr_2O_3	FeO	Al_2O_3	MgO	CaO	Si_2	MnO	P_2O_5	S	H_2O
Cuba	50.0	18.57	12.44	13.38	2.16	3.82	....	0.45	0.69	....
California	52.68	15.30	11.40	16.23	....	3.40	0.15	....	....	0.94
Turkey	51.7	14.2	14.1	14.3	1.7	3.5	....	....	....	0.3
Turkey	52.8	10.24	10.48	13.96	2.37	0.2	0.2	0.05	....	1.05
New Caledonia	55.7	13.2	16.2	9.8	0.25	6.95	....	....	0.06	....

The composition of the ore varies considerably according to the sources, but an average analysis for that used for electric-furnace smelting is: 50% Cr_2O_3; 25% FeO; 10% Al_2O_3; with CaO, MgO, SiO_2, etc., variable within rather wide limits.

Electric furnaces for the production of ferrochromium are similar to either the Siemen's crucible furnace or to the Heroult furnace. The method of producing ferrochromium for the market is essentially as follows: Finely ground chromiferous iron ore is mixed with anthracite coal and shoveled into the furnace around the electrodes, charging being continued at periodic intervals so that the top of the mix remains unfused. The reduction takes place and the alloy is tapped from the furnace into iron receivers, which are dumped when the poured metal freezes. The product is broken and packed in kegs or boxes for shipment. Alloys containing as low as 5% carbon can be economically produced in one reduction, but for higher-grade ferrochromiums a subsequent refining is demanded.

In general, the first product contains from 60 to 65% chromium and from 5 to 9% carbon. To give the low-carbon alloy, this first product is then remelted and decarburized. In refining, the alloy is treated with a mixture of chromiferous ore, fluorspar and lime, the amount used being a function of the impurities to be removed. The alloy is covered with this mixture and heated. It is thus possible to reduce the carbon to as low as 0.25%, but the usual percentage is about 0.5.

Gustave Gin describes the decarburization of ferrochromium as follows:

"When fused carburized ferrochromium is superheated in the presence of an oxidizing slag and the entire mass allowed to cool, it is regularly found that as it cools down the surface of the previous tranquil bath becomes the seat of ebullition, at first slight, but increasing in intensity up to the moment immediately preceding solidification. It is likely that this ebullition is caused by the disengagement of the oxide of carbon, due to deoxidation of the dissolved oxide by the carbon present in the alloy. It is naturally very difficult to account for these circumstances and the exact causes of the phenomenon, because in any of the observed cases neither the variations of heat of formation of the metallic carbide nor the oxide present are known; nor are the variations of the specific heats of the components and the products within the temperature ranges considered known exactly. We feel, however, that this is an example of the principle advanced by Le Chatelier, that an increase of temperature favors endothermic reactions and a lowering of temperature exothermic reactions."

Rossi, the well-known titanium investigator, has made ferrochromium in the electric furnace containing

TABLE III. ANALYSES OF CHROMIUM-BEARING STEELS

	Elements %								
Use	C	Si	Mn	P	S	Cr	W	Mo	V
Tool steel	1.16	2.89	0.21	0.047	0.038	2.74	.....	.....	.....
Tool steel	0.66	0.08	0.08	0.018	0.016	3.43	16.81	.....	0.11
Tool steel	0.64	0.05	0.01	0.015	0.012	3.73	14.06	.....	0.11
Tool steel	0.82	0.18	0.26	0.003	0.016	3.71	14.63	0.017	0.20
Tool steel	0.59	0.22	0.06	0.028	0.023	2.86	18.81	.....	.....
Axles; side, main and connecting rods	0.25 0.30	....	0.40 0.30	.....	.....	1.00	.....	.....	0.16 0.18
Axles, bolts, hammer rods	0.20	....	0.30 0.40	.....	.....	0.50	.....	.....	0.12
Car axles, holding bolts, etc	0.20	....	0.40	.....	.....	0.80	.....	.....	0.16
Wheels, gun barrels, crank pins	0.45 0.55	.....	0.80 1.00	.....	.....	1.25	.....	.. ..	0.18
Casehardening steel for parts	0.12 0.15	....	0.20	.....	.....	0.30	.....	.....	0.12
Armor plate	0.25	....	....	.....	.....	1.50	.....	.....	Ni 3.25

68.24% chromium, 1.85% silicon, 1% carbon and 0.5% aluminum from an ore containing 50% Cr_2O_3. Neumann employed a ferrosilicon containing 91.65% silicon and 1.03% carbon, as a reducing agent for the production of ferrochromium. His product analyzed 38.05% chromium, 2.53% silicon and 0.87% carbon. Moissan made ferrochromium in the electric furnace by the reduction of chromite with carbon, obtaining an alloy analyzing 60.9% chromium, 31.6% iron, 6.1% carbon, and 1.1% silicon.

Chemistry of the Alloy

Keeney has demonstrated that a chromium steel can be made in the electric furnace directly from hematite and chromite; the control of the carbon in the product by means of the carbon charged is difficult if chromium

is present. He also showed that ferrochromium can be readily made directly from chromite in the electric furnace; that the percentage of carbon in the ferrochromium cannot be held low by regulating the amount of carbon charged unless there be high chromium loss in the slag; that the percentage of carbon in the ferrochromium must be regulated by decarburization with an oxide slag of iron or chromite after tapping the slag from the first reduction; that the silicon and phosphorus cannot be held low in the product under the strong reducing action required, and that the sulphur can be caused to readily enter the slag.

In the crucible, chromiferous ore is reduced with carbon, using a flux consisting of lime, borax, fluoride or water glass. The thermit process is one of direct reduction, being dependent for its success upon the strong affinity of oxygen and aluminum, as is well known. The aluminum robs the chromite of its oxygen with the result that chromium is reduced.

A soft ferrochromium has been put out by the Société la Néo-Métallurgie with as low as 0.25% carbon, and the Goldschmidt Thermit Co. makes carbon-free ferrochromium. The Société has produced a ferrochromonickel containing 16 to 38% iron, 5 to 60% nickel and 24 to 27%; chromium has been made which contained 50% chromium, 8 to 10% silicon, 38% iron and 2% carbon.

Chromium in Alloy Steels

The use of chromium in alloy steels has markedly increased, and its employment promises to further increase on account of the special properties it confers upon the metal. It is desirable as an alloying constituent, also because it may be introduced with relative ease in the manufacture of alloy steels. In a word, the effect of chromium on steel may be briefly stated as follows: It does not act as a scavenger, removing oxides and occluded substances as do titanium, manganese and silicon, nor does it confer soundness on the steel in the manner of silicon and aluminum. Added in small amounts, it increasese the tensile strength of the steel to some extent, without markedly decreasing its ductility; but when added in too large amounts, it causes brittleness. Both of the foregoing effects are dependent upon the amount of carbon present.

Chromium, when added to steel, raises the normal critical range, thus causing the changes to take place at elevated temperatures and also more slowly. Hence chromium-bearing steels are harder than ordinary steels because quenching more effectively prevents the transformation of the austenite. When added to iron, chromium does not materially harden the metal, and chromium-bearing iron or very low-carbon chromium steel will not harden even when submitted to drastic water quenching. The chromium steels contain from 1 to 4% or more of chromium, and the carbon may range from 0.50 to 2%; such steels are normally employed in the hardened condition. Chromium is commonly associated with nickel or vanadium for special purposes. Table III gives some analyses of various chromium-bearing steels.

Chromium steels are well adapted for use in the manufacture of armor plate and for armor-piercing projectiles, as well as for automobile parts, and in other cases where great hardness and high tensile strength are desired. Chromium steels are employed for making steel tires and springs for railway purposes, file steel, plows, burglar-proof safes, automobile forgings, armor plate and armor-piercing projectiles, tool steels, axles, connecting, side and main rods; transmission parts, crankpins, gears, bolts, wheels, gun barrels, casehardening steels, and for some other uses. In combination with nickel, chromium forms the now well-known chrome-nickel steel of the trade. Recently it has been employed with tungsten for magnet purposes.

Manganese in Arkansas

Washington Correspondence

Much attention is being focused on the maganese development in progress in west-central Arkansas. Owing to the important part that this region may play in the ability of the United States to care for its own needs of this important mineral, there is unusual interest in the following description of the occurrence and character of these ores, by Hugh D. Miser:

The manganese ores occur as nodules, pockets and short irregular veins from a fraction of an inch to 4 ft. thick. Thicknesses of 4 ft., however, are rare, and those of a foot are not common. The orebodies are scattered through the hard novaculite and can doubtless be found on every mountain where the Arkansas novaculite is exposed. The ores occupy bedding planes or joint cracks or form a cement in a novaculite breccia, in which the rock fragments range from a fraction of an inch to over a foot in diameter. The iron and manganese ores may be intimately mixed in the same pocket or vein, they may occur separately in different parts of the same vein, or they may occur in separate masses. Most of the ore is confined to two stratigraphic horizons in the Arkansas novaculite.

The ores consist of oxides, four of which, psilomelane, pyrolusite, manganite and wad, have been identified; if others are present, they probably occur in minute quantities. Although these minerals may be found separately, as a rule two or more are intimately mixed in the same deposit, and in some places they are associated with iron ores and manganiferous iron ores. Psilomelane, pyrolusite and manganite form the larger part of the manganese ore in this region. A material consisting of rock fragments and clay cemented together by soft manganese oxide is present at a number of places; locally it is known as "bog ore."

Waste In Ore-Cleaning Operations

By A. L. H. Street*

Reviewing a suit in which the operator of a custom mill sued to recover compensation for cleaning ore-bearing dirt and rock and in which the defendants counterclaimed damages for asserted waste of ore in the operation, the Springfield, Mo., Court of Appeals holds that defendants were not entitled to show in evidence that other dirt taken from the same pile and from the same mine to another mill yielded 2% more mineral than plaintiff recovered; there being no proof of a substantial similarity in the conditions covering the amount of ore recovered at the other mill. (Osborne vs. Eyster, 192 Southwestern Reporter, 143.)

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Cost of Crosscutting on the Mother Lode*

An investigation was recently made in Amador County, California, for the purpose of ascertaining and comparing results obtained in crosscutting, in the belief that such information would be of value to the operators in the district.

MOST of the crosscuts in the Mother Lode mines are in the slates and what are commonly termed greenstones (chiefly diabase and amphibole schist). No two crosscuts were driven under the same operating conditions. The chief factor of difference, and the factor upon which the most dependence must be placed, was the hardness of the rock. This was determined only by observation in the crosscuts. Even with the most complete knowledge of the nature and hardness of the rock, there would still remain the fact that it would break more or less easily, depending on the direction of the drive with regard to stratification or cleavage. There were many other points of difference in conditions under which the work was done. On this account care must be used in drawing conclusions from the data given.

All the information was secured by personal visits to the mines. As much of the data as possible is tabulated the remainder is in the form of comments on the various operations. It has been thought desirable to refer to each crosscutting operation only by number.

TABLE OF DATA RELATING TO THE DRIVING OF TEN CROSSCUTS IN VARIOUS CALIFORNIA MINES

Op. No.	Hardness of Rock 1–5	Distance Driven, Ft.	Size of Cross-Cut, Ft.	Ventilation	Average Length of Tram, Ft.	Grade of Track, %	Type of Drill Used	Kind of Bit	Air Pressure at Drill, Lb. per Sq. In.	Depth of Holes, Ft.
1	5	94	6 x8 7 x9	Fair	Various	1.5	Piston	Cross	85–90	5½–6
2	5	346	7 x9	Fair	Various	1.5	Water Hammer	Carr	85–90	5½–6
3	4	100	5x6½	Good	1,000	...	Hammer Stoper	Carr	90	5
4	4	500	6 x9½	Fair	275	0.2	Water Hammer	Carr	90–95	5
5	4	427	5½x7	Poor	1,318	5.0	Hammer	Cross	70–90	5½
6	5	172	7 x9	Poor	140	0.66	Piston	Cross	75	5½
7	4	357	7 x9	Poor	180	0.5	Piston	Cross	80	5½–7
8	3–4	450	5 x6 7 x9	Poor	2,190	0.84	Piston	Cross	80	6
9	4–5	150	6 x7½	Fair	85	...	Water Hammer	Cross	90	5 –6
10	3	432	5 x7	Poor	210	1.5	Piston	Cross	85	5

Op. No.	No. of Holes per Round	Shifts to Drill Round	Advance per Drill Shift, Ft.	Shifts Worked Per 24 Hours	Day's Pay Contract	Kind of Fuse Used	Strength of Cap	Kind of Powder Used	Lb. Powder per Round	Cost per Ft. Labor and Explosives
1	15–16	3	1.5–2	2	DP	Comet	6x	30% Ammo-Gel.	62	$6.12
2	15–16	1–1½	4	2	DP	Comet	6x	30% Ammo-Gel.	62	3.82
3	16	1	4.25	1	DP	Delay Expl.	..	35% Gel. Dyn.	50	3.62
4	16	1	4.5	2	DP	Delay Expl.	..	35% Gel. Dyn.	50	3.42
5	11–13	1½	2.60	1	DP	Eclipse Special	6x	40% Gel. Dyn.	30	4.38
6	15	2	2	3	DP	Pacific	6x	40% Ammo-Gel.	50	5.87
7	12	1	5	2	C	Pacific	6x	40% Ammo-Gel.	62	3.94
8	11	1½	3.66	3	DP[1]	Aneroid	6x	40% Nit. Gly.	30	4.07
9	12	5/8–6/8	5	3	DP	Pacific	6x	35% Ammo-Gel.	38	3.07
10	8–10	5/8	4.5	1	C	Pacific	6x	40% Ammo-Gel.	30	3.36

[1] Bonus paid: Machinemen received $3 per day, chuck tenders and muckers $2.50 per day. For every 5 ft. over 50 ft. per week, all men received 25 cents per day additional.

*Abstract of Bulletin No. 5, California Metal Producers' Association, by Edwin Higgins, 625 Market St., San Francisco.

All the crosscuts are in the hard greenstone of Amador County except operations No. 8 (hanging-wall slate), No. 9 (andesite and schist) and No. 10 (slate). Five degrees of hardness were selected, No. 5 being the hardest. Fortunately, most of the rock encountered was uniformly hard.

For fear of creating an erroneous impression regarding the use of some particular drill, it was decided not to mention the make, but simply to divide the drills into two classes, piston drills using solid steel, and hammer drills using water through hollow steel. In practically all the operations one-ton, steel, end-dump cars were used and shoveling was done either from a steel sheet or from planks. Hand-tramming was used in all the operations except No. 3, in which mules were used. The track gage in all cases was 18 in., and 16-lb. rails were used except in operations Nos. 6 and 10, where 12-lb. rails were used. No timber was used, except in operations Nos. 5, 6 and 7, which required a few sets each.

Costs shown in the table were figured only on labor and explosives, the following charges being made for labor: Drillmen, $3; chuck tenders and muckers, $2.50. More complete costs appear in the additional notes on the various operations. No overhead charges are included except where expressly stated.

ADDITIONAL NOTES ON THE VARIOUS OPERATIONS

Operation No. 1. This work was done in 1915, the cost of the 94 ft. being:

	Cost	% of Total Cost
Drilling (labor)	$295.25	41.2
Mucking and tramming	192.50	26.8
Supplies	48.50	6.8
Powder (at 11c. per lb.)	181.45	25.2
Total	$717.70 or $7.63 per ft.	

Operation No. 2. Of the 346 ft., 239 were driven in 1916 and 107 ft. in 1917. The 1916 costs were:

	Cost	% of Total Cost
Drilling (labor)	$785.25	31.4
Mucking and tramming	583.25	23.3
Powder	946.45	37.9
Track, ties and incidentals	186.43	7.4
Total	$2,501.38 or $10.46 per ft.	

COSTS FOR 107 FT. MADE DURING 1917

	Cost	% of Total Cost
Drilling (labor)	$292.00	27.6
Mucking and tramming	327.00	30.9
Supplies	84.20	8.0
Powder (at 17c. per lb.)	354.20	33.5
Total	$1,057.40 or $9.88 per ft.	

In operation No. 3, firing was done electrically from a 110-volt line, with switch, using delay exploders. In operation No. 4 practically the same cycle of operations as No. 3 except that two shifts were worked.

Since this work was done the 1¼-in. round, hollow steel with cross-bit, one set of which sufficed to drill only one hole, has been discarded in favor of 1-in. hexagon, hollow steel, with Carr bit. Drilling speed has increased 25% or more, and the new steel drills from five to eight holes without resharpening. The drill has been equipped with a striking block, or anvil block.

COST OF DRIVING 426.5 FT.

	Cost	% of Total Cost	Cost per Ft.
Timbering[2]	$51.88	1.8	$0.12
Drilling	1,084.16	36.9	2.54
Mucking and tramming	521.73	17.8	1.22
Explosives	670.48	22.8	1.59
Candles	18.60	0.6	0.04
Hoisting	591.10	20.1	1.38
Total	$2,937.95	100.0	$6.89

[2] Not timbered throughout.

Most of the work in operation No. 5 was done with one drillman on the first shift and one mucker on the second shift. During the period, July, 1916 to February, 1917, 426.5 ft. was driven at the cost shown in the table.

In all, 163.5 drill-shifts were worked, which gives an average advance of 2.6 ft. per drill shift.

The cost for the 172 ft. in operation No. 6 was $1255 ($7.30 per ft.), which does not include air, hoisting, drill sharpening or superintendence. The work was done in July, 1916. In operation No. 7 drillers and muckers made from $4 to $4.50 per ft. on contract. Ventilation was by compressed air with water spray used after shooting. Two shifts were worked.

DETAILED COST PER FOOT OF CONTRACT WORK

	Cost per Ft.
Drillers (2)	$2.78
Trammers and shovelers	2.22
Timbermen	.30
Powder	2.42
Fuse	.19
Caps	.06
Candles	.10
Timber	.36
Power	.58
	$9.01

In operation No. 8 the cost per ft. of 1015 ft. of drifting under all conditions; all timbered and from soft to very heavy ground were,

	Cost per Ft.
Drillers	$3.90
Engineers	.12
Trammers and shovelers	3.81
Timbermen	1.20
Powder	1.19
Fuse	.13
Caps	.05
Candles	.20
Timber	1.90
Power	.60
	$13.10

OPERATION NO. 9. DETAILED COST FOR 150 FT. OF CROSSCUT

	Cost per Ft.	
Explosives	$142.00	
Steel	20.00	
Timber	37.30	
Pipe	22.50	
Air	20.00	
Labor	993.60	
Total	$1,235.40	or $8.24 per ft.

COST OVER A DISTANCE OF 100 FT.

700 lb. powder at 17c	$119.00	
220 caps at $1.30 per 100	2.86	
1,320 ft. fuse at $5.20 per 1,000 ft	6.86	
160 lb. steel at $0.093 per lb	14.90	
100 ft. 2-in. pipe at 16c. per ft	16.00	
Contract 100 ft. at $4.50 per ft	450.00	
Air	20.00	
Total	$629.62	or $6.30 per ft.

Track, superintendence, surveying and power bring the total cost up to $10.34 per foot.

The best progress in operation No. 10 was 53 ft. over a 10-day period, or at the rate of 160 ft. per 30 days. The average rate was about 120 ft. per month. Actual drilling time for a round was 5 hours, setting up and tearing down taking up 2 hours.

Track, superintendence, surveying, assaying, apportionment of power, hoisting, etc., bring the cost up about $3.60 per ft., making the total cost $9.90 per foot.

All drilling and shooting was done on day shift. Mucking and laying planks and track was done on night shift; 378.5 man-shifts were worked, or 153 shifts day and night.

Comments on the Various Operations

Operations 1 and 2 afford a fair comparison of the solid-steel piston drill, as compared with the water-hammer drill. The 94 ft. of operation No. 1 were driven with a piston drill, three shifts being required to put in a round of holes. At this point (see operation No. 2) a change was made to the water-hammer drill, after which a round of holes was drilled in from 1 to 1½ shifts.

Attention is directed to the greater percentage of total cost chargeable to drilling in operation No. 1, as compared with No. 2. The increased cost of explosives and supplies in operation No. 2 is due largely to the increase in the cost of these materials in 1916 and 1917.

Operation No. 3 is one of two out of the ten in which delay exploders were used. A minimum of misfires occurred, and results were reported better than blasting with cap and fuse. This crosscut was run with a hammer stoper and good progress was made. The section of the drift was small compared with the other operations. It was reported that the fact that drilling was done on one shift and mucking on the next made for economy but not speed. Keeping of drill parts in duplicate was an important factor in lessening delays.

No. 4 was an efficient operation. A very important bit of information was brought out at this mine; namely, the change from 1¼-in. hollow, round steel with cross-bit, to 1-in. hollow, hexagonal steel with Carr bit, which greatly increased the drilling speed and the number of holes that could be drilled with one set of steel.

The striking feature of No. 6 is the slow progress made with the solid-steel piston drill. No. 7 is a case in which good progress was made with the piston drill. However, the ground was not of the hardest at all times and the fact that the work was done on contract had some effect on the speed. No. 8 is a striking illustration of what can be done in crosscutting by day's pay plus a bonus. An average of 77 ft. was made every week. No. 9 showed the lowest cost in labor and explosives.

The cost of operation No. 1 was abnormally high for the reason that there was no other work being done in the mine and all charges were directed toward this one crosscut. The progress was excellent, but on account of the fact that the ground was not as hard as any of the other operations, it is hardly fair to use this operation in comparison with the others.

As indicated previously, it is believed that operations 1 and 2 afford the best comparison between the solid-steel piston and the water-hammer drills. However, one such operation cannot be taken as conclusive. While comparisons from the table are by no means accurate on account of varying conditions, it is of interest to note the following:

Omitting operation No. 10, the average number of shifts required to drill one round of holes was 1.81 for solid-steel piston drills and 1.14 for the water-hammer drills. The average advance per drill-shift was 3.10 ft. for the piston drills and 4.07 for the water-hammer drills. The average cost per foot in labor and explosives was $5 for the piston drills and $3.66 for the water-hammer drills.

Making a further distinction, the average cost per ft. in labor and explosives shows $3.62 for the water-hammer drills using the Carr bit; $3.72 for the water-hammer drills using the cross-bit; $5 for solid-steel piston drills with cross-bit.

Quicksilver production in Italy in 1916 amounted to 1,093,851.5 kg., according to "Rassegna Mineraria." In 1915 the production was 985,514 kg.

Corrections for Sag in Long Steel Tapes

By W. H. Rayner
Instructor in Civil Engineering at the University of Illinois, Urbana, Ill.

The corrections to be applied to steel-tape measurements have been discussed by many investigators whose results have been presented in various ways.[1] However, there are so many variable conditions and requirements governing such measurements that a different treatment of the theory is occasionally warranted by the demands of practice. Obviously, some corrections might be applied in base measurements which would be neglected in other work; and again, mining surveys with long tapes on steep slopes impose different considerations

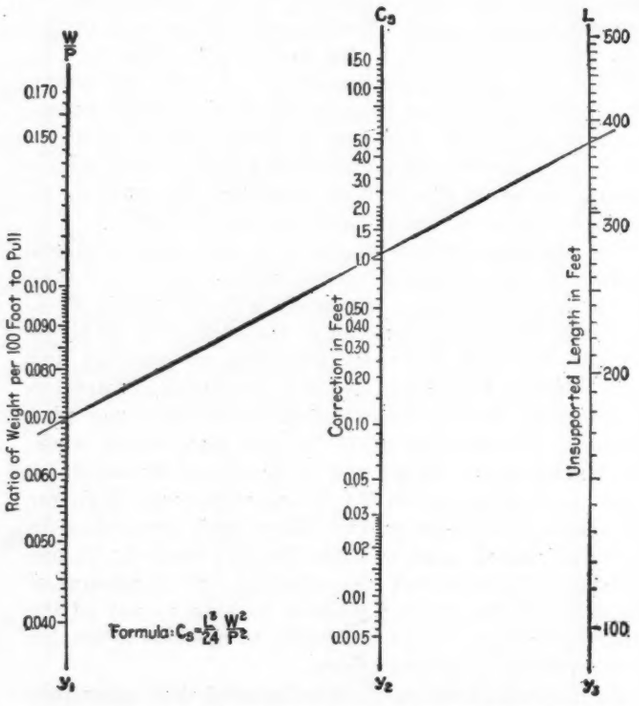

FIG. 1. CHART FOR DETERMINING CORRECTION FOR SAG IN STEEL TAPES

from those that would apply to measurements taken under different conditions. The corrections for sag, in most cases, are the most troublesome to make, especially in the case of the longer tapes; and since for most classes of surveys these corrections are not required to be determined to more than two or three significant figures, it is thought that a graphical solution would probably be more useful than tables. The corrections for temperature and stretch are in simple and direct relation to the distances measured and are not considered in this discussion.

In Fig. 1 are given the corrections for sag under various conditions of weight, pull and length, for tapes from 100 to 500 ft. in length. In this diagram use has been made of the nomograph to deal with the four variables involved. For any given tape the weight is a constant, hence the relation between weight and pull may be expressed as a ratio which becomes one variable $\frac{W}{P}$ in the nomograph. The units for the different quantities are shown on their corresponding ordinate lines in the diagram.

The use of the nomograph is very simple, and one example will be given to illustrate it. A 500-ft. tape weighs 7 lb., or 1.4 lb. per 100 ft. A distance is measured with a pull of 20 lb. where the unsupported length is 375 ft. What is the correction for sag in this case?

Solution: The ratio of weight per 100 ft. to pull $\left(\frac{W}{P}\right)$ equals $\frac{1.4}{20}$ or seventy hundredths. The unsupported length L is 375 ft. Place a straight-edge across the nomograph to intersect these two quantities on their corresponding ordinate axes, and the middle ordinate is intersected at a point which reads 1.08 as the correction due to sag alone.

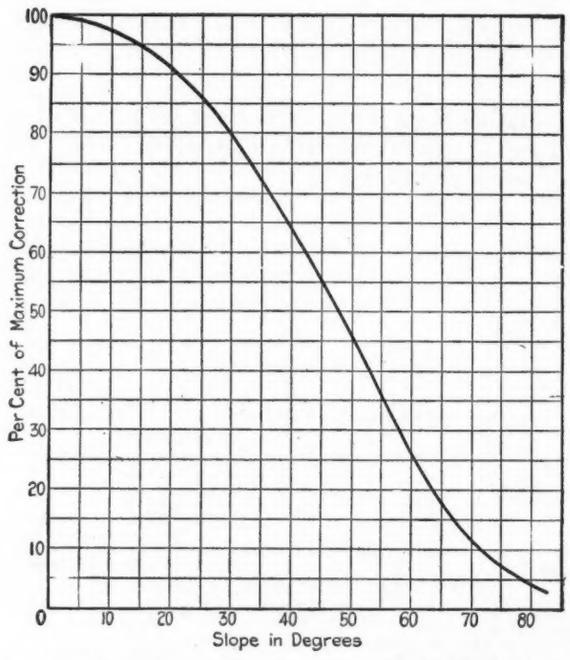

FIG. 2. CHART FOR DETERMINING CORRECTION FOR SAG IN STEEL TAPES ON SLOPE

The effect of slope on sag corrections is shown in Fig. 2. This curve has been prepared from data given by E. V. Huntington and shows the percentage of maximum correction for the various slopes. For example, suppose that the above measurement had been made on a 20° slope. From the curve it is seen that the correction for sag on a 20° slope is 91% of the maximum, and accordingly the final correction due to sag is 91% of 1.08 ft. or 0.98 ft.

It is possible that some engineers in the field would like to make use of such a diagram to a larger scale; hence, the following directions are given, which may be followed without any knowledge of the theory of nomographic construction.[2] First, construct three vertical

[1] "Mathematical Theory of Metallic Tapes"; Report U. S. Geological Survey, 1892, Appendix No. 8, p. 480. "A Graphical Method for the Correction of Steel Tapes"; Walter Scott Weeks in University of California Publication in Engineering, Vol. I, No. 9; price 10c. E. V. Huntington, of Harvard University, in L. S. Marks' "Mechanical Engineers' Handbook." See also various textbooks.

[2] For a complete description of this theory and method, see "The Construction of Nomographs," by H. E. Babbitt, Proc. Ill. Soc. of Engrs. and Surveyors, 1916, p. 164.

lines (ordinate axes), which we may consider as being numbered y_1, y_2 and y_3 from left to right. The intervals y_1 to y_2 and y_1 to y_3 must be in the exact ratio of 3.6 to 6. Second, plot to any scale and beginning at any point on y_1 the logarithms of the numbers 40 to 170, and to the same scale beginning at any point on y_3 plot the logarithms of numbers from 100 to 500. This means that the linear distance from 100 to 170 on y_1 must be exactly the same as the distance from 100 to 170 on y_3. Third, solve the given equation, $C_s = \frac{L^3}{24} \frac{W^2}{P^2}$ for a number of selected conditions to give values of the correction which will be evenly distributed over the ordinate y_3. Fourth, subdivide this ordinate to any further degree desired and number the scale accordingly.

Some Suggestions on Economy

By H. T. Durant*

Economy for obvious reasons is practiced to a far greater extent now than ever before, or at least for some time. Even when peace eventually comes, the effect of the present world situation will still be evident. All the readers of the *Journal* are primarily interested in some branch of engineering, and many have probably had at times to do some hard thinking in the direction of economy of time or materials. It is always easier to take the line of least resistance, especially when not handling one's own money, and for that reason economy often starts late in the day or, perhaps, when there is no other alternative.

In every department of every large undertaking it is possible to lay down certain regulations, instructions, standing orders—call them what you will—which for all practical purposes do not change from day to day or from month to month. A separate set of such orders would be made out for each department, which orders would be issued to the department concerned, typewritten or printed. They are not then misunderstood or forgotten like verbal ones; it is the duty of all employees concerned to know these orders.

This procedure causes great saving of time and supervision, does away with much useless talking and reiteration. It is, therefore, only emergencies and special conditions which cannot always be provided for in standing orders, but must be dealt with by foremen or management when they arise.

A very fruitful source of waste is in ordinary business-letter writing. A long letter is usually bad. Letters should be to the point, clear and complete and without ambiguity. Letters that are written in purposely indefinite terms are an insult to the intelligence of the recipient, and leave him with no illusions as to the characteristics of the orginator of the letter. Badly written letters cause much subsequent correspondence.

The case is very much the same with contracts, estimates, specifications, etc. In all these there is ultimate economy if the original work on paper has been done honestly; otherwise, legal assistance may be required later on, and it is uncertain when and how that may end. Where work is measured in hours instead of output, as often must be the case, it is more than ever vital that due consideration be given to the welfare of the workers, whatever rank they may occupy. It is a matter of common knowledge that, in some places, it is no uncommon thing for workers coming on at, say, 6 a.m. on a cold winter morning to do 1½ or 2 hours work (often heavy manual work) before taking any food. Probably only those who have actually tried it know the exact value of this kind of work. It is often preceded by a journey or walk, it does not represent the worker's average effort and it is not good for the worker's health. Care and skill are exercised on the design, layout, maintenance and insurance of a power plant, and apparently the same applies to the human machine.

Obviously, overtime cannot be economical and should be avoided as much as possible. Quick decision and some knowledge of human nature are essentials in obtaining confidence of subordinates—more so than skill at trade or occupation.

To come to the more concrete side of economy or waste, there is a very common one appreciated by every mining engineer; that is to say, waste dumps of various kinds. Waste rock or waste material, such as residues from cyanide works, concentrating mills, etc., should as far as possible be dumped at a high level, and in a convenient position for rehandling, and each class of material should be dumped separately.

I know of at least one case in which nearly a million tons of metalliferous residues, the product of many years, has during the whole period of its collection been dumped with boiler ashes and various other barren materials. As a result, the mixture is at present of no value. Had the residue in question been properly and separately dumped, it would now, by modern methods, have become a very considerable asset. Some of us could cite instances of gold and silver tailings being run into rivers or being allowed to spread themselves naturally in shallow layers over large areas.

Low-priced machines that have a high maintenance and running cost are a source of waste; it may be a long time before the machine can be scrapped and replaced by a machine which can be run and maintained reasonably. Especially in out-of-the-way places, it is economy to fall into line with one's nearest neighbors, if any, as regards class, etc., of machinery installed; this may permit the giving and receiving of a certain amount of friendly assistance, and incidentally it prevents the carrying of heavy stocks of spare parts, renewals, etc.

No mill of any kind can be laid out and brought satisfactorily to a ready-to-run condition except with the cooperation of or under the supervision of someone who has actually worked in such mills. Unless the mill is sited, designed and erected under such supervision, it will require more or less extensive adjustment after it starts running, and even then its running costs may always be too high. With pipes and fittings, it is often good practice to carry out the work in as few different sizes as possible, even if by this means the pipe services are in some cases larger than demanded, for in this way a smaller and less varied stock of pipes, valves, fittings, etc., is carried.

The same procedure, to some extent, applies to pulleys, belting and shafting, and by a little ingenuity and planning it is possible to use belting in few widths, not in too many different thicknesses (plies), and to have shafting and therefore all its details in a reduced number of sizes.

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Artificial Covellite

BY J. M. FRANKEL
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About two years ago a specimen piece of chalcocite was broken in handling, and to keep the two pieces together an ordinary rubber band was put around them. During an examination of this specimen some weeks later, the rubber band was moved to one side, exposing a black streak, much resembling lampblack. On the supposition that rubber and chalcocite under ordinary conditions were inert compounds, this apparent reaction seemed curious. That the streak was not accidental was proved by repeating the experiment, when a similar result was obtained after a few days' exposure of the chalcocite to the influence of the rubber.

The attention of Dr. Graton was called to this phenomenon. Dr. Graton had the experiment repeated, rubber, flour of sulphur, and a crystal face of sulphur being used, all of which gave the black powder on the surface of the chalcocite.

An approximate analysis of the black powder showed it to be a copper compound with a composition corresponding to the formula CuS. The experiment was repeated with various forms of rubber, such as red-rubber packing, conveyor-belt rubber and eraser rubber. All gave the same result, the strongest action coming from the sheet packing.

CHALCOCITE AND RUBBER PACKING

It was observed upon examining a piece of chalcocite that had been subjected to the action of some red-rubber packing for more than a year that the black powder usually formed, had changed in spots to a powder of the characteristic blue color of covellite. This blue powder, after several months' exposure to the influence of the rubber, had the appearance of an incrustation of minute crystals. Specimens of this incrustation were shown to Professor Butler, of the University of Arizona, who stated that they were undoubtedly covellite.

A small piece of native copper from Michigan has been tried and the same result obtained, except that instead of being black, the powder produced is blue, similar to the blue spots formed on the chalcocite.

Thus far the results of the experiment may be summarized as follows:

1. Chalcocite in contact with rubber for a few days, under ordinary conditions of pressure, temperature and light, becomes coated with a black powder. After about a year and a half of exposure to the action of the rubber, this powder turns blue in spots, and a few months later these blue spots assume a crystalline appearance.

2. The composition of the powder and the color of the crystals are those of covellite.

3. The rubber appears to be but little more affected than it is by ordinary long exposure to the air.

4. The action is not confined to the actual points of contact between the rubber and the chalcocite, but is distributed all over the surface of the chalcocite facing the rubber, and on the adjacent sides. It varies in intensity proportional to the distance. The inference is, of course, that the action is due to some volatile compound of sulphur contained in the rubber.

5. Native copper in contact with rubber, under the same conditions as the chalcocite, also becomes coated with a blue powder. An investigation has not been made to see whether this powder is also covellite, or whether chalcocite is not actually formed first and the covellite from it, instead from the copper direct.

The results of this experiment would indicate that chalcocite in the presence of a volatile sulphur compound becomes converted into covellite: $Cu_2S + S = 2CuS$.

In the series of changes incident to the process of secondary enrichment of copper ores, it has always been assumed that covellite is a transition product formed between chalcopyrite and chalcocite. The results of this experiment would point to covellite being in some instances a secondary product after chalcocite, and not always a transition product.

Australian Mineral and Metal Exports

The following figures of exports are taken from the official reports of G. H. Knibbs, Commonwealth Statistician of Australia, for the years ended June 30, 1915, and June 30, 1916:

Substance	Unit	1914–15	1915–16
Alunite	Cwt.	52,400	12,800
Ammonium sulphate	Cwt.	113,801	129,651
Antimony ore	Cwt.	50,316	74,631
Bismuth ore	Cwt.	1,295	2,602
Coal	Tons	1,371,745	929,998
Coke	Tons	14,329	25,253
Copper—ingot and matte	Cwt.	669,189	737,841
Copper ore	Cwt.	141,578	89,035
Copper concentrates	Cwt.	785	347
Copper sulphate	Cwt.	86	44
Gold—bar, dust, ingot, sheet and in matte	Oz.	198,809	254,355
Gold—ore, quartz and concentrates	Cwt.	15,654	6,232
Iron, pig	Cwt.	37,450	53,494
Iron, ore	Cwt.	78,041	156,800
Lead, pig and matte	Cwt.	2,164,871	2,458,134
Manganese ore	Cwt.	5	10,315
Metal scrap (except iron and steel)	Cwt.	25,260	24,424
Molybdenite	Cwt.	2,080	2,569
Phosphate, rock	Cwt.	22,340	75,839
Platinum ore	Cwt.	87	91
Platinum, bars, blocks, etc	Oz.	70	79
Plumbago, black lead, etc	Cwt.	373	394
Quicksilver	Lb.	600	647
Scheelite and wolframite	Cwt.	10,315	19,720
Silver, bar, ingot, sheet and matte	Oz.	6,851,405	6,591,518
Silver and silver-lead ore	Cwt.	104,596	3,415
Silver and silver-lead concentrates	Cwt.	448,577	192,150
Tin, ingots	Cwt.	29,891	68,690
Tin ore	Cwt.	40,215	44,066
Tin concentrates	Cwt.	2,630	4,050
Zinc bars, blocks and rods	Cwt.	53,561	46,000
Zinc concentrates	Cwt.	2,409,815	3,688,599
Zinc ore	Cwt.	.....	505

The metal content of ores and concentrates exported, estimated from assay were as follows:

		1914-15	1915-16
Gold ore, quartz and concentrates:			
Gold	Oz.	12,153	5,812
Silver	Oz.	18,720	14,836
Bismuth	Cwt.	26	30
Silver and silver-lead ore and concentrates:			
Silver	Oz.	681,467	259,094
Lead	Cwt.	374,798	111,172
Zinc	Cwt.	22,350	15,801
Gold	Oz.	345	.....
Copper ore and concentrates:			
Gold	Oz.	43	9
Silver	Oz.	3,398	5,960
Copper	Cwt.	22,482	16,176
Tin ore and concentrates:			
Tin	Cwt.	29,310	32,813
Zinc ore and concentrates:			
Silver	Oz.	1,609,545	1,692,980
Lead	Cwt.	186,536	206,294
Zinc	Cwt.	1,070,066	1,632,180

In addition to the total quantities, the reports give details of the amounts going to various countries, and also the states from which the metal was exported. They also include figures of imports by countries of origin and importing states.

Areas of Segments of Circles

By W. B. Marquard
Professor of Mining, Lafayette College, Easton, Penn.

There is frequent need for an easy formula for finding the area of a segment of a circle, since this area is needed in calculating the contents of horizontal cylinders for various depths of the liquid in the cylinder. The content of such a cylinder equals the area of the segment times the length of the cylinder.

No satisfactory formula has been developed for finding the area of circular segments in terms of the radius and altitude of the segment. All exact formulas involve the central angle subtended by the chord of the arc, and it is a difficult matter for a practicing engineer to make use of such formulas when the altitude of the segment alone is given.

AREAS OF CIRCULAR SEGMENTS

Formula used, Area $= R^2 \text{ arc vers } \frac{h}{R} - (R - h)\sqrt{2Rh - h^2}$

Depth	Area / R^2	Log Area / R^2	Depth	Area / R^2	Log Area / R^2
1/60 R.	0.00408	$\bar{3}.61066$	31/60 R.	0.64320	$\bar{1}.80839$
2/60 R.	0.01145	$\bar{2}.05881$	32/60 R.	0.67252	$\bar{1}.82770$
3/60 R.	0.02091	$\bar{2}.32035$	33/60 R.	0.70216	$\bar{1}.84644$
4/60 R.	0.03211	$\bar{2}.50664$	34/60 R.	0.73209	$\bar{1}.86456$
5/60 R.	0.04478	$\bar{2}.65108$	35/60 R.	0.76224	$\bar{1}.88209$
6/60 R.	0.05872	$\bar{2}.76879$	36/60 R.	0.79267	$\bar{1}.89909$
7/60 R.	0.07381	$\bar{2}.86812$	37/60 R.	0.62334	$\bar{1}.91558$
8/60 R.	0.08993	$\bar{2}.95391$	38/60 R.	0.85424	$\bar{1}.93158$
9/60 R.	0.10705	$\bar{1}.02959$	39/60 R.	0.88535	$\bar{1}.94712$
10/60 R.	0.12502	$\bar{1}.09698$	40/60 R.	0.91670	$\bar{1}.96223$
11/60 R.	0.14376	$\bar{1}.15764$	41/60 R.	0.94821	$\bar{1}.97690$
12/60 R.	0.16350	$\bar{1}.21352$	42/60 R.	0.97991	$\bar{1}.99119$
13/60 R.	0.18387	$\bar{1}.26451$	43/60 R.	1.01180	0.00509
14/60 R.	0.20492	$\bar{1}.31158$	44/60 R.	1.04385	0.01864
15/60 R.	0.22666	$\bar{1}.35538$	45/60 R.	1.07610	0.03185
16/60 R.	0.24900	$\bar{1}.39620$	46/60 R.	1.10839	0.04469
17/60 R.	0.27190	$\bar{1}.43441$	47/60 R.	1.14087	0.05724
18/60 R.	0.29548	$\bar{1}.47053$	48/60 R.	1.17347	0.06947
19/60 R.	0.31957	$\bar{1}.50457$	49/60 R.	1.20619	0.08106
20/60 R.	0.34416	$\bar{1}.53676$	50/60 R.	1.23901	0.09311
21/60 R.	0.36945	$\bar{1}.56756$	51/60 R.	1.27193	0.10476
22/60 R.	0.39483	$\bar{1}.59641$	52/60 R.	1.30492	0.11559
23/60 R.	0.42083	$\bar{1}.62411$	53/60 R.	1.33904	0.12659
24/60 R.	0.44730	$\bar{1}.65060$	54/60 R.	1.37113	0.13708
25/60 R.	0.47418	$\bar{1}.67594$	55/60 R.	1.40433	0.14747
26/60 R.	0.50143	$\bar{1}.70021$	56/60 R.	1.43756	0.15763
27/60 R.	0.52910	$\bar{1}.72354$	57/60 R.	1.47083	0.16756
28/60 R.	0.55711	$\bar{1}.74594$	58/60 R.	1.50415	0.17729
29/60 R.	0.58549	$\bar{1}.76752$	59/60 R.	1.53746	0.18681
30/60 R.	0.61419	$\bar{1}.78830$	60/60 R.	1.57080	0.19612

Note—Areas for various depths of segments are found by multiplying numbers in the second column by the square of the radius. To facilitate the work of computation in making a table to show contents of tank for various depths the logarithms of the areas are given in the third column. The logarithms of the contents in cubic feet for the various depths are found by adding the sum of the logarithms of the length of the tank and twice the logarithm of the radius to the tabulated logarithm in the third column. The logarithm of the contents in gallons is found by adding the logarithm of length and twice the logarithm of radius and log 7.4805 to the tabulated logarithm in the third column (Log 7.4805 = 0.87393). When the depth is greater than the radius the area of the major segment must be found, which equals the area of the circle ($3.14159\ R^2$), less the tabulated area of the small segment.

A number of approximate formulas have been developed for finding the area of segments. The simplest one gives area as $\frac{2}{3}\ AL$, where A is the altitude and L is the length of the chord of the segment. This formula assumes that the arc of the circle corresponds to the arc of a parabola and gives quite close results when the altitude of the segment is less than one-fifth of the radius; it cannot be used when the altitude is over one-quarter of the radius. Other formulas for finding approximate areas of segments do not readily permit the use of logarithmic computation and, furthermore, are far from accurate.

The accompanying table has been constructed to give accurate areas of segments for various altitudes that range from one-sixtieth part of the radius up to the radius.

The area of the major segment is found by subtracting the area of the tabulated small segment from the area of the circle ($3.14159\ R^2$). Areas for various altitudes are found by multiplying numbers in the second column of the table by the square of the radius. Each division of the first column represents an altitude of one-sixtieth part of the radius. Hence areas are shown for every inch of 5-ft. circle, or for every 0.4 in. of a 2-ft. circle, etc.

A table showing the contents of horizontal cylinders for various depths of the liquid can be easily made by using the following table of segment areas. The use of logarithms is urgently advised in making a table showing the contents of tanks. The following illustrations show a method of obtaining the contents in cubic feet and also in gallons:

Radius = 5 ft. Length = 12 ft. Log $R^2L = 2.47712$

Depth	Log. Volume, Cu.Ft.	Volume, Cu.Ft.
5/60 R = 5 inches	$\bar{2}.65108 + 2.47712 = 1.12820$	13.43
25/60 R = 25 inches	$\bar{1}.67594 + 2.47712 = 2.15306$	142.25
60/60 R = 60 inches	$0.19612 + 2.47712 = 2.67324$	471.24

If it is desired to find the contents in gallons, add the log ($7.4805\ R^2L$) to the tabulated logarithm in the third column of the table:

Radius = 3 ft. Length = 10 ft. Log ($7.4805\ R^2L$) = 2.82827

Depth	Log. Volume, Gal.	Volume, Gal.
5/60 R = 3.0 inches	$\bar{2}.65108 + 2.82817 = 1.47925$	30.15
25/60 R = 15.0 inches	$\bar{1}.67594 + 2.82817 = 2.50411$	319.24
60/60 R = 36.0 inches	$0.19612 + 2.82817 = 3.12429$	1,057.5

A Decimal Coinage for Great Britain

The full report of the British Institute of Bankers on the adoption of a decimal coinage and the metric system of weights and measures has been made public. The committee that prepared the report believes that the adoption of the metric system will be of great advantage, especially in the extension of foreign trade. As a prelude to the adoption of that system, it believes that a decimal system of coinage should de adopted and therefore recommends such a system.

For many reasons, among which is its general acceptance as a standard in foreign as well as domestic trading the pound sterling must be retained as the unit, and the system recommended by the committee is based upon the pound sterling. A standard unit of so high a value as the pound involves the division into 1000 instead of 100 parts. The present pound contains 240 pence, or 960 farthings, so that the smallest division—one-thousandth—would be very nearly the value of a farthing. This division the committee would call a "mil." The coinage proposed is as follows: Gold, pound or sovereign, and half-sovereign. Silver, double florin, 200 mils; florin, 100 mils; half-florin, 50 mils; quarter florin, 25 mils. The half-florin would correspond very nearly to the present shilling. Nickel, 10-mil piece, copper, four-mil, two-mil and one-mil pieces. A four-mil instead of a five-mil piece is recommended because its value would be almost exactly the same as that of the present penny, which is a general standard in small transactions. The difference in value would be only 4%, which would not be noticeable in these small coins.

Flotation Process at Real del Monte and Santa Gertrudis*

The Real del Monte, Pachuca, Hidalgo, Mexico, has erected a 50-ton Minerals Separation plant at its cyanide plant near Omitlan. A mixture of oils is used, the proportion of each, per ton of ore treated being: Barrett No. 1 coal-tar oil, 1.319 lb.; Barrett No. 609 creosote, 1.319 lb.; No. 80 pine oil, 0.200 lb. Costs of operations are given as $1.57 (U. S. currency) per ton, the following results having been obtained:

FLOTATION RESULTS AT REAL DEL MONTE

Extraction by difference—63.9% Ag 60% Au.
Tonnage—Dry Pulp 1.038 tons per hour.
Dilution—4.91 Water to 1 Ore.
Conditions of solutions—Traces of CaO.

Oils employed:

Barrett No. 1 coal tar	1.319 lb. per ton
Barrett No. 609 creosote	1.319 lb. per ton
Pine tar No. 80	0.200 lb. per ton
Total oil	2.838 lb. per ton

Contents:	Grams Ag	Grams Au
Heads	382	1.25
Tails	134	0.50
Extraction	248	0.75

Assay of Froth from Compartments

	Ag	Au
1–2–3	5.909	22.00
4	3.961	14.25
5–6	1.779	6.00
7–8	1.274	4.00
9–10	1.964	6.00
11–12	2.595	1.25

At Santa Gertrudis K. & K. and Callow machines have been installed with average recoveries of 72%, although as high as 78% has been obtained.

There are being constructed in the company shops, additional K & K machines for an ultimate capacity of 160 tons per day.

*Abstract, "Informe sobre el tratamiento de los minerales por flotacion en los Compañias Mineras Pachuca y Real del Monte y Santa Gertrudis," by Simeon Ramirez, Inspector of Mines, in "Boletin Minero," Mexico, May 1, 1917.

Petroleum Supply Decreasing

The nation is warned in a statement issued by A. C. Bedford, president of the Standard Oil Co., that the supply of oil products is decreasing alarmingly. He says:

In view of the abnormal conditions confronting the nation, it is peculiarly important that the country should understand the serious situation now prevailing in the petroleum industry.

This country is producing crude oil at the rate of about 300,000,000 bbl. a year, but it is using it at the rate of 335,000,000 bbl. a year. The amount of crude oil in storage, all grades, May 1, 1917, was 165,688,797 bbl. The country is absorbing the entire current production and drawing very rapidly upon its reserve supplies.

The rapid development of the automobile is largely responsible for present conditions. In 1910 there were 400,000 automobiles in use in the United States; in 1916 the number was 2,350,000. Today there are more than 4,000,000 cars, demanding over 40,000,000 bbl. of gasoline a year. Other uses of gasoline and oil are expanding upon an enormous scale.

The demand for oil products is greater than the supply of crude oil. Because of the demand, the price of crude oil has risen, thus stimulating more and more producers to drill new wells. Though this drilling has been going on with great aggressiveness—because the cost of drilling is much greater than in the past and the total successes fewer than ever—the returns from such efforts are not as satisfactory as they were a year ago. In the first three months of this year 4701 wells were completed, yielding an initial production per day of 344,876 bbl. In 1915, 1711 new wells yielded 349,010 barrels.

In other words, though there have been almost three times as many new wells drilled in 1917 as in 1915, the initial production is considerably less than in 1915. The drilling of wells is still going on, but thus far there has been no increase in production over last year or the year before.

The meaning of the foregoing is this: If our Government is to have the petroleum it will need to prosecute the war successfully and supply all necessities directly growing out of the war, two steps will have to be taken, namely:

1. The public will have to economize in the use of gasoline. Sufficient gasoline should be available to provide for all normal uses of automobiles. But pleasure riding should be curtailed. People should look upon their automobiles as necessities to be used only when needed. Not a gallon of gasoline should be used in the present emergency except for some useful end.

2. Every oil producer in the country should be encouraged as a patriotic effort to secure the utmost possible output of crude oil. The present expense of drilling new wells is very great and increasing, and the results are often discouraging. But there is oil to be had if producers in the oil business will redouble their efforts to get it out of the ground.

The petroleum industry has gone into this situation wholeheartedly and with an eye single to assisting the Government in its stupendous problem, and I am convinced that the Government, on its part, will meet the situation in a liberal and broad-minded spirit and that a just price will be paid, sufficient for the maintenance and development of industry.

In reliance, therefore, on the good faith of the Government, there should be no relaxation on the part of producers in their efforts to turn out oil, and every private individual and industry should consider it a patriotic duty to observe all possible economy in the consumption of gasoline.

Acquisition of Water Rights

BY A. L. H. STREET
Attorney at law, 829 Security Building, Minneapolis, Minn.

Under the laws of California, where a mining company has diverted water from a stream for a period of five years, such continued use, adverse to the rights which owners of downstream lands might have asserted, a prescriptive right to continue the diversion arises, according to a late decision of the California Supreme Court in the case of E. Clemens Horst Co. vs. Tarr Mining Co., 163 Pacific Reporter, 492. But, on the same authority, it is the law that the lower landowners may restrain a subsequently increased diversion of the water where the right of the mining company to divert the increased quantity has not been acquired by similar prescriptive use.

Ingenious Mill Run by Water Power

BY J. W. SWAREN*

An ingenious water-power driven mill and amalgamator has been constructed for working the soft ore of a prospect near Georgetown, Calif.

The overshot wa'erwheel, made entirely of wood, is approximately 16 ft. in diameter. The shaft consists of a 12 x 12-in. timber turned to fit wooden bearings. The spokes of the waterwheel are 4 x 4 in., bolted to the shaft. The wheel buckets are built of 1 x 12-in. planks.

On the end shown in the illustration, two 20-gal. wooden casks are used for amalgamation. On the opposite end, by means of wooden gear and pinion, a grinding mill of the chilean type is driven. The rolls of the chilean mill are steel burrs that have outlived their usefulness in an abandoned grist mill. These turn on a stone-floored wooden vat, and no screens are employed. The ore is simply dumped into the mill and ground un il the mixture of ore and water seems sufficiently thin for amalgamation; the outfit is then stopped, the charge of the mill transferred to the amalgamator, a new charge put in the mill and operation continued. The main wheel runs at about 49 r.p.m., while the mill turns at about 3 r.p.m. The percentage of recovery was not obtainable, but the operators seem to be well satisfied with results.

AN INGENIOUS WATER-POWER-DRIVEN MILL, NEAR GEORGETOWN, CALIF.

FERROTUNGSTEN EXPORTS from the United States in May were 463,680 lb., the largest ever reported in one month. Practically no ferrotungsten was exported before the war. Ferrovanadium exported in May was 311,360 lb., a little less than in March, but more than in any other previous month.

*Box R, R, 2 Hayward, Calif.

A Blast-Furnace Record

BY F. K. BRUNTON

Smelting Superintendent, Consolidated Arizona Smelting Co.

Ten tons per square foot of hearth area is the reremarkable record made by a 14-ft. blast furnace at the smeltery of the Consolidated Arizona Smelting Co., at Humboldt, Ariz. The furnace is a rectangular water-jacketed furnace. The following table gives complete data concerning it:

FURNACE DATA

Width at tuyeres	52 in.
Length of furnace	168 in.
Sq.ft. hearth area	60.66
Height of furnace	11 ft. 6 in.
Distance tuyeres to top	8 ft. 6 in
Distance tuyeres to sole plate	3 ft.
Diameter of tuyeres	4 in.
Center to center tuyeres	15 in
Number of tuyeres	22
Tuyere area	276.46 sq.in.
Tuyere area per sq.ft. of hearth area	4.56 in.
Cu.ft. air per minute	20,000
Air pressure	26 to 30 oz.
Tons smelted per 24 hours	609
Tons per sq.ft. hearth area per 24 hours	10.04
Per cent. coke	9.3

It taps from the side through a water-cooled copper breast jacket with a water-jacketed spout and a water-cooled copper lip into a pear-shaped settler 27 ft. long, 13 ft. wide and 55 in. deep. It has practically no crucible as it is bricked up to within three inches of the tuyeres on each end and the bottom slopes toward the middle so that it is just below the connection hole at the center.

The furnace is fed mechanically with six charge cars of the old Anaconda type, having a capacity of 60 cu.ft. each, and dumped by means of an air lift.

The charge is put in as follows: Two cars of coke holding 800 lb. each are dumped in, followed by two cars of ore of 8000 lb. each on top of it from the same side of the furnace. This is repeated on the other side of the furnace for the next charge. The charge consists of ore, converter slag and limestone, and has the following composition: 33.5% SiO_2, 26.8% Fe, 8.6% CaO, 10.4% S, 3.12% Cu, which, with an 80% sulphur elimination, gives a 38% matte, and a slag running 40% SiO_2, 30% Fe, 10.2% CaO, 0.25% Cu.

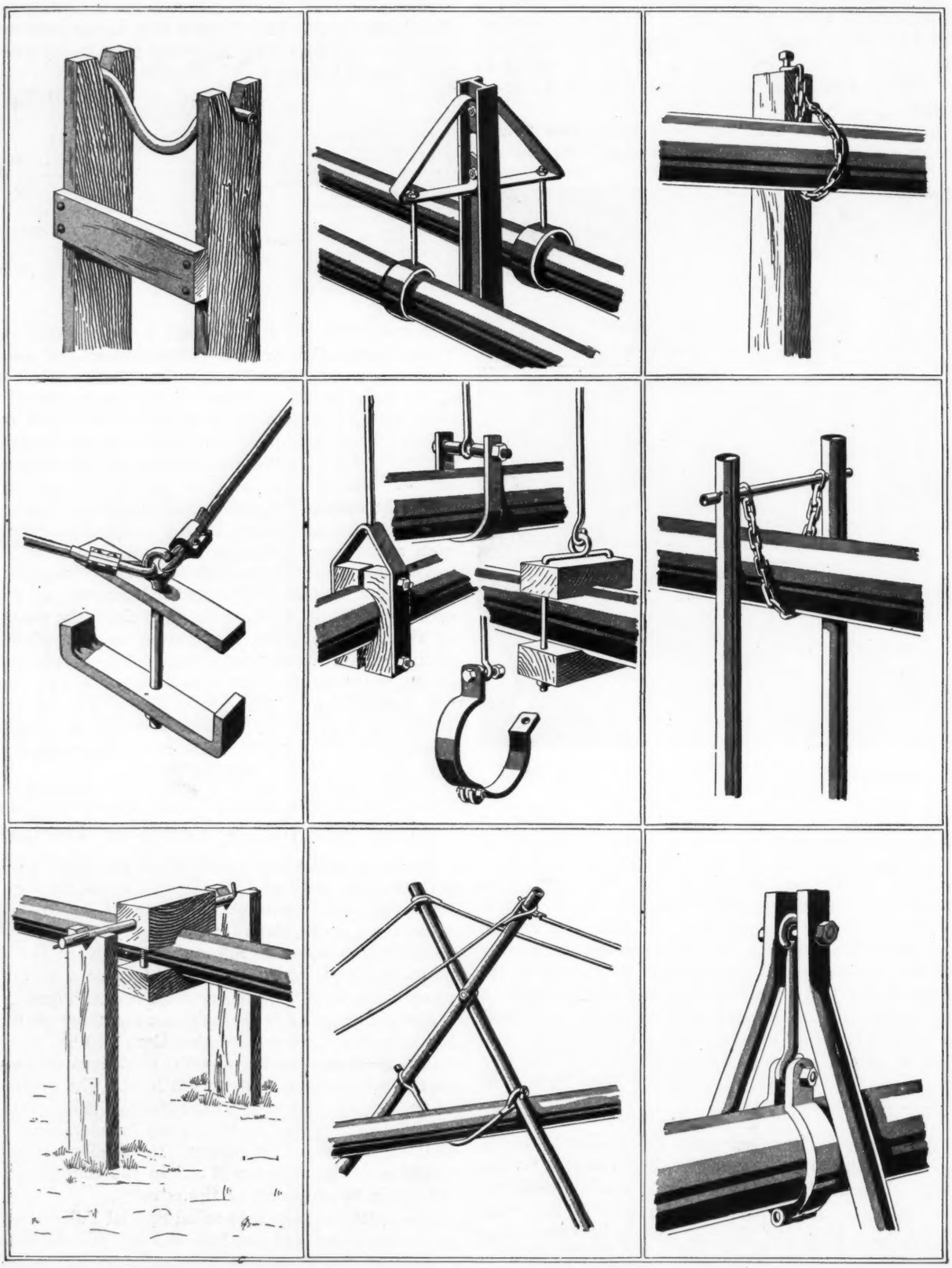
Use Mean Sea Level as Datum

In the pamphlet just published by the Coast and Geodetic Survey, entitled "The Use of Mean Sea Level as the Datum for Elevations," is discussed the desirability of having a single plane for the whole country, to which all elevations would be referred. This plane is that of mean sea level, which is supposed to be a continuous plane throughout the country from ocean to ocean.

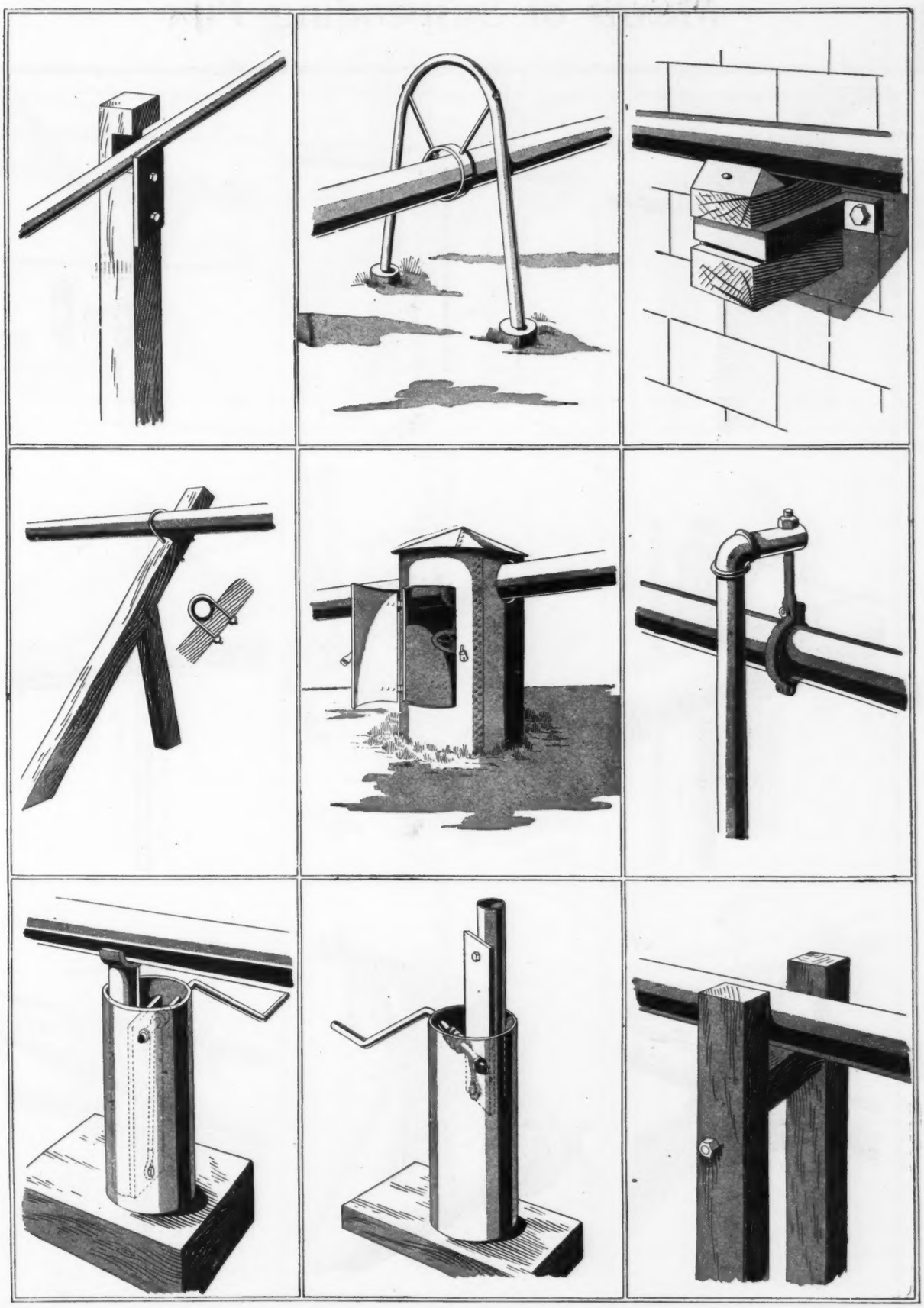
For a number of years the Coast and Geodetic Survey has extended a network of elevations of high accuracy, inland from the coasts, with the elevations of its monuments all referred to mean sea level. The publication of the present report is to encourage the adoption and use of mean sea level as the datum for elevations by all civil engineers and surveyors. It is believed that the adoption of this plane will aid in the commercial and industrial development of the country.

The pamphlet, which is called Special Publication No. 41, of the Coast and Geodetic Survey, may be obtained free of charge from the Division of Publications, Department of Commerce, Washington, D. C.

Means of Suspending Pipe

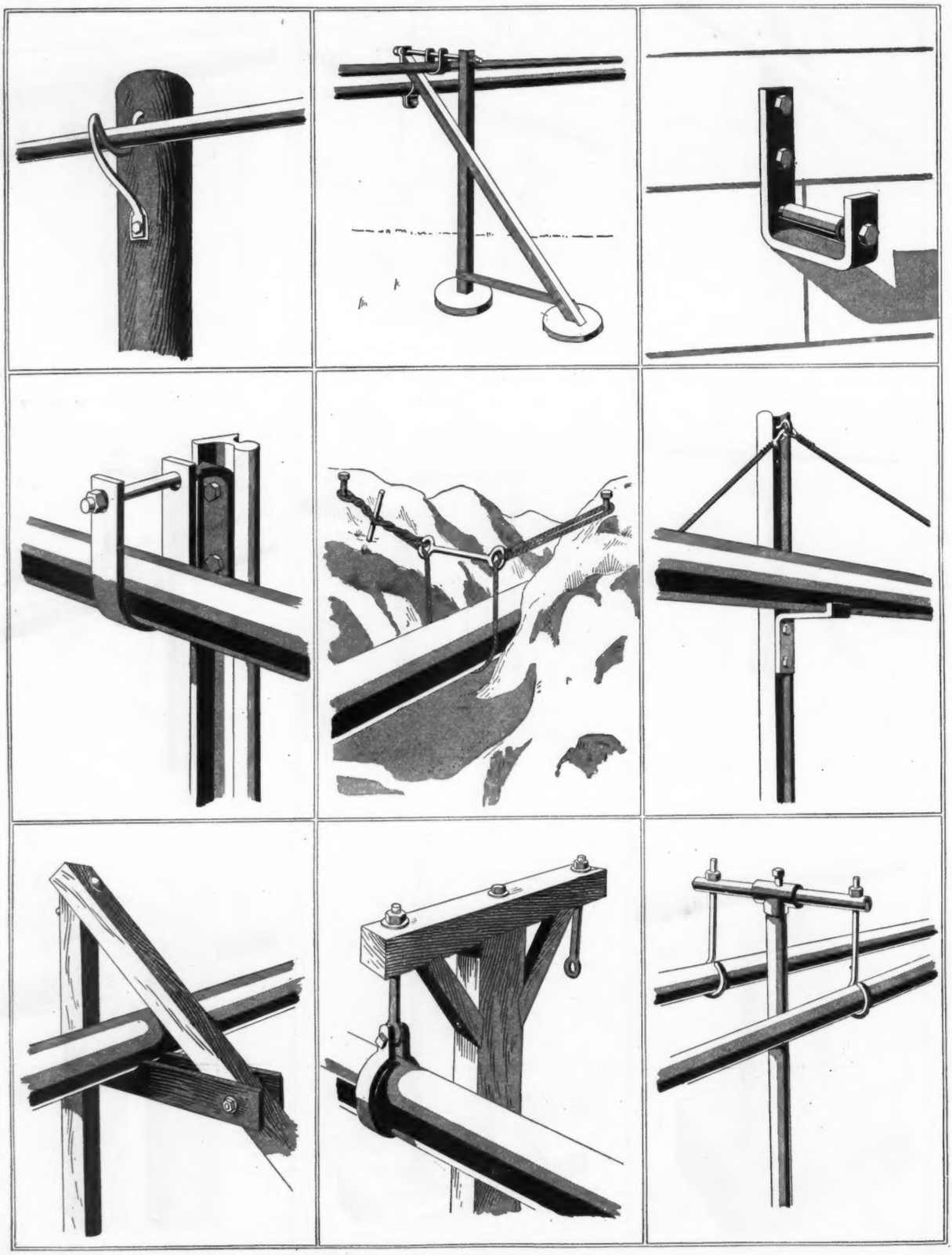


AT MINES AND METALLURGICAL WORKS MANY METHODS ARE USED FOR SUSPENDING THE LARGE

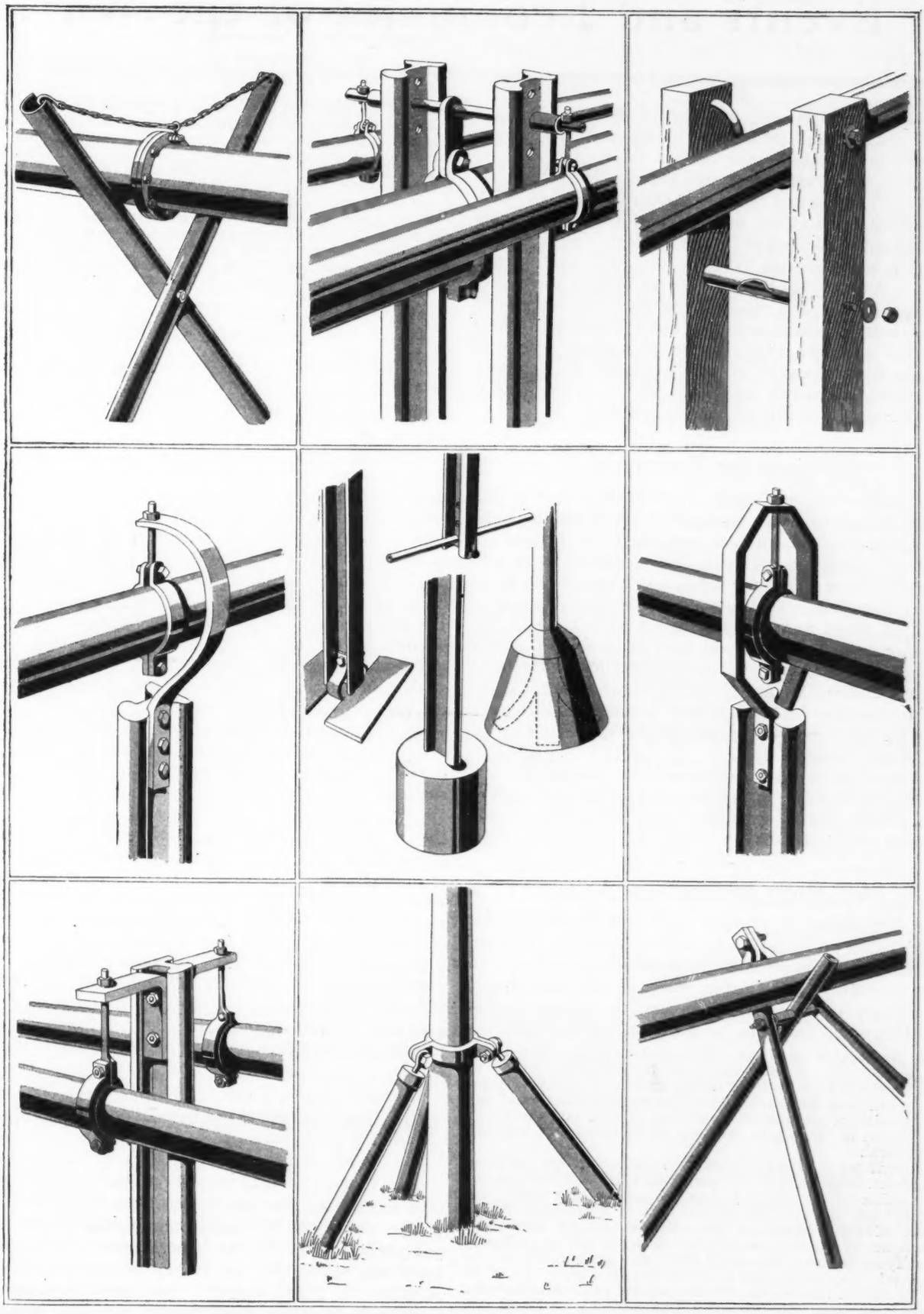


AMOUNT OF PIPE REQUIRED, THE PARTICULAR SCHEME ADOPTED DEPENDING UPON CONDITIONS

Means of Suspending Pipe



THESE PAGES SHOW THIRTY-SIX SCHEMES FOR PIPE SUSPENSION AND MAY



SERVE TO GIVE USEFUL SUGGESTIONS FOR MEETING ANY SET OF CONDITIONS

Events and Economics of the War

During the last week the British drive in Flanders absorbed the attention not only by reason of the possible results to be gained—the Belgian Coast—but also because of the power manifested against the German attack. The situation remains turbulent in Russia, with Kerensky again at the head. The Russians are being driven out of Bukowina by the Teutonic forces.

At home, Congress talks on the food and revenue bills. An embargo has been placed against the export of ship steel. Steel ships of over 2500 tons being built have been commandeered by the Government. Men for the National Army are being selected. Support of the Government is urged upon labor by Gompers. No visible move has been made as yet to suppress I. W. W. agitators throughout the country.

Work for Engineers

Brigadier General Black, chief of engineers of the army, says: American engineers must undertake large operations in construction and repair of bridges in France. They must repair and maintain roads and highways over which our supplies will be brought up to the battle line. To accomplish this work, the same kind of street and road equipment as is used in our leading American cities will have to be shipped to the front. Our engineers will equip piers and wharves in France utilized by American forces with terminal facilities required by our armies. Lumber for this work will be cut from European forests by regiments of American foresters.

Special mining companies will be formed for the purpose of carrying on the intricate operations involved in modern trench warfare. For this work expert miners will be chosen.

Avoiding Manganese Waste

A translation of a paper read at a meeting of the Association of German Ironmasters, made by Sir Robert Hadfield, appears in a recent issue of *Iron Age*. In the discussion of the paper, which is also reproduced, a member of the association said in regard to the creation of an Institute for Metallurgical Research:

A plethora of problems will confront the Institute about to be founded. Among them are the desulphurization of blast-furnace coke and the saving entailed thereby of manganese in blast-furnace working, the desulphurization of and elimination of manganese from Thomas slag and the better utilization of the waste products of metallurgical working in general.

Permit me to discuss briefly, in particular, one of these problems. Just picture to yourselves that, with the present utilization of our Thomas slag, we are causing each year 300,000 tons of iron and 150,000 tons of manganese, in the form of their oxides to be scattered on the fields and meadows of foreign countries, which is not particularly gratifying to these, nor can it afford any gratification to our economic life, seeing that it represents an annual loss of 20 to 30 million marks. If we can succeed in abstracting the manganese and iron from the Thomas slag, we shall not only save a great part of this loss, to the benefit of our national economy, but in consequence thereof we shall, moreover, reduce by many hundred thousands of tons the quantity of manganese and iron ores to be extracted from our mines by us per annum. I will only mention incidentally that in the end this will also afford some relief with regard to the whole labor question, which after the war will confront us in an accentuated form.

Every practical man will clearly understand how important the solution of these questions is for our whole economic life. And, thanks to the high esteem in which we hold science, we may confidently hope that we shall find the key to the solution of most of them.

Shortage of Oil

Following closely on the warning of President Bedford of the Standard Oil Co. that we are headed directly for an oil famine, comes word that the Defense Council expects the supply to run short.

"Data secured by the navy," says the New York *Sun*, "indicate that the total shortage may amount to more than 120,000,000 bbl. Production is expected to decrease approximately 9,000,000 bbl. unless the navy reserves are tapped or the output of the Mexican field is increased. The Defense Council probably will urge upon the country the strictest conservation of oil, even if the output is increased by resorting to the reserves. The army's recent order for 25,000 motor trucks will be followed by other large contracts, so that added motor transportation alone will call for an enormous amount of gasoline. The great aircraft program and the ever-growing demand for oil by the navy for its ships will require millions of barrels more."

In view of the threatened shortage at home, the figures of the Foreign Commerce Bureau, showing the expansion in the country's export business in mineral oils, are of interest. According to these figures for the 11 months of the fiscal year ended June 30, as given in the New York *Times*, total shipments abroad of mineral oils of all classes reached the unprecedented total of 2,483,601,229 gal., the value of which was placed at $203,756,064. In the corresponding period of 1916 such shipments were 2,220,211,439 gal., worth $146,822,199, while in 1915 period the outgoing shipments aggregated 1,975,861,237 gal., valued at $120,243,484. These totals covered such products as crude, gas, fuel, refined, illuminating, lubricating and heavy paraffin oils, as well as gasoline and naphthas of various classes.

Nonessential Railroad Construction Undesirable

The Railroads' War Board earnestly recommends that during the war the railroads be required by the public authorities to make improvements and carry out projects involving the expenditures of money and labor only when they are absolutely essential for war purposes or public safety. The prevailing high interest rate on money, the difficulty of raising money in

competition with the tax-free issues of the Government, the excessive cost of supply and labor, the delay in obtaining material, the possible blockade of traffic and the diversion of labor all contribute to make nonessential construction undesirable during the war.

The board considers that the erection of new stations and the elimination of grade crossings are among the nonessential improvements which should be deferred. It suggests that the basis for consideration of new projects at this time should be the increase in the capacity of the carriers for national service.

The Liberty-Loan Cycle

Through the sale of Liberty-Loan bonds the United States is borrowing large sums of money from its citizens, its business men, farmers, bankers, wage earners, merchants, manufacturers. The Government collects this money and disburses it in two ways. Part it expends itself and part it loans our allies. The United States and these other governments spend it for American products and American labor, and it goes back directly into the hands of the people, the American business man, farmer, banker, wage earner, merchant and manufacturer.

This is the cycle. John Smith, the farmer, and Thomas Brown, the wage earner, each has purchased a Liberty-Loan bond, paying down the initial payment of 2%. On June 28 they made the 18% payment, depositing the amount in their banks and sending checks to the Federal Reserve Bank of their district. The Federal Reserve Bank collects the check and redeposits the money with the local banks. Later the Treasury Department draws against it and the money is again lodged with the Federal Reserve Bank. It is almost immediately withdrawn from the Federal Reserve Bank either by the United States or by some foreign government engaged in war with Germany to which the United States has advanced money and is paid out for American products or labor.

Therefore the money paid in by the aforementioned John Smith and Thomas Brown, on June 28, in part payment of their Liberty-Loan bonds may have got back into their hands in time to make up part of their payments due on July 30.

Government Buys Rails

In its last issue, *Iron Age* says:

Chief of passing developments have been the buying of 150,000 tons of rails by the Government for the building of a double-track railroad from its French port to its battle front, a marked reduction in output of steel works and rolling mills due to the extreme heat in all producing districts, and the efforts of manufacturers in steel and metal-working lines to have exempted from conscription enough employees to hold output of war materials where it is.

The Government's railroad operations in France will be on a large scale, and a vast engineering program is involved. There will also be considerable buying of light rails for portable tracks. The standard sections just bought are 80-lb. rails. Either bessemer or openhearth rails will be accepted. For the Government's French railroad 300 locomotives have been ordered, and there are negotiations for 17,000 cars, About 100,000 kegs of spikes are wanted.

Du Ponts in Coal-Tar Dye Field

The entry into the coal-tar dye-making field is announced by E. I. du Pont de Nemours & Co. An extensive plant, says the New York *Tribune*, has been started at Deepwater, N. J., adjoining the company's chemical department.

After years of study of the dye industry the company now feels warranted in investing the millions needed to put the industry on a basis to meet the competition of the German manufacturers after the war. The great development of the company in the manufacture of explosives and chemicals has brought it logically into the field of synthetic-dyestuffs manufacture.

The development will be progressive, starting with certain products and increasing as rapidly as possible. The company's laboratories, with their experts, will be at the disposal of all consumers.

Changes in the Shafroth Bill

WASHINGTON CORRESPONDENCE

Material changes have been made by the House Committee on Mines and Mining in Senator Shafroth's bill providing for the suspenson of assessment work on mining claims. The amended bill will be reported to the House within the next few days as follows:

To suspend the requirements of annual assessment work on mining claims during the year 1917.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That in order that labor may be most effectively used in raising and producing those things needed in the prosecution of the present war with Germany, that provision of section 2324 of the Revised Statutes of the United States which requires on each mining claim located, and until a patent has been issued therefor, not less than $100 worth of labor to be performed or improvements to be made during each year, be, and the same is hereby, suspended during the year 1917: Provided, That every claimant of any such mining claim in order to obtain the benefits of this act shall file or cause to be filed in the office where the location notice or certificate is recorded on or before Dec. 31, 1917, a notice of his desire to hold said mining claim under this act.

This act shall not be deemed to amend or repeal S. J. Res. 33 of the Sixty-fifth Congress.

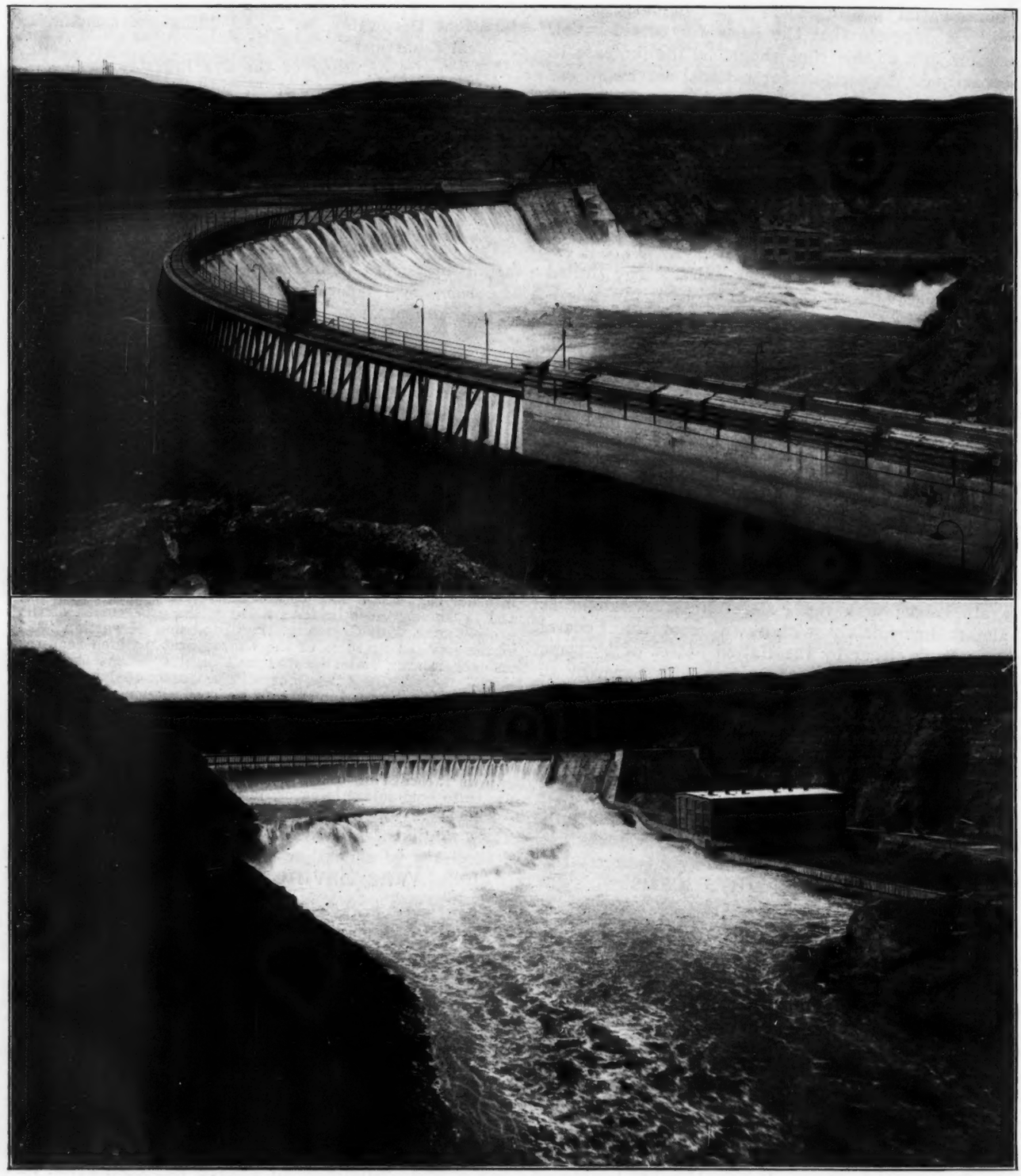
War Savings Certificates

The New York *Tribune* says the Treasury is considering the issuance of war-savings certificates, possibly in denominations as low as $5, in connection with the next installment of the Liberty Loan. Certificates may be purchased at post offices, to be converted into bonds when the owner has accumulated a sufficient number.

Director General of Railways

President Felton of the Chicago Great Western road, designated several months ago to direct operations for railroad rebuilding in France, has been given authority by the War Department to oversee all purchases of railroad materials by the department and supervise routing of troop trains in this country. He will have the title of Director General of Railways.

Photographs from the Field



GREAT FALLS OF THE MISSOURI RIVER WHICH SUPPLY POWER TO THE ANACONDA SMELTING WORKS AT ANACONDA, MONT.

This power development of the Montana Power Co. was completed in 1916. The Great Falls, the largest of the five falls of the Missouri River near the City of Great Falls, Mont., have a natural drop of 78 ft. The concrete dam, with 14-ft. steel flashing, develops a working head of 150 ft. About 60,000 hp. is developed at 6600 volts and stepped up to 110,000 volts for transmission. Besides the reduction works at Anaconda, power is supplied to two sections of the St. Paul's electrified railroad. A high-tension bus line also ties in this development with the Rainbow Falls power plant, and the Anaconda refineries and smelting works at Great Falls

The Agnew, a typical small pit operation on the Mesabi range, near Hibbing, Minn.

The Albany mine, near Hibbing, where the milling system of mining is used; the Morris mine is shown in background

VIEWS SHOWING TWO METHODS OF MINING ON THE MESABI IRON RANGE IN MINNESOTA

Correspondence and Discussion

The Smelters and the Mines

I have not seen any reference in the *Journal* to the abnormal conditions existing between the custom smelters and the independent miners and operators that now prevail in the Southwest and throughout the mining sections of the country at large. Briefly, the situation is as follows: The high price of metals has brought about a large production of ore. Mines having contracts with the smelters or offering ore of high value can dispose of their products. Those properties having no contract and producing ores of only moderate value are unable to find a market.

This condition necessarily restricts the development of properties and discourages the prospector and independent operator, who are the real discoverers and developers of large properties. Without them there would be no properties.

The reason given by the smelters for refusing ore is that they are overstocked. This, in a measure, is true, but is not the whole truth. To the outsider the situation appears as follows: The smelters own mines or control mines and are constantly acquiring further control of other mines by purchase or otherwise. The mining department of the smelting firms never take over the property that is not already extensively developed and proven. They never risk money, as does the prospector and independent operator, to develop a small property or a prospect. The only property they will take over is one in which there is sufficient ore blocked out and in sight, not only to cover whatever money they pay out on purchase account, but to cover all costs of mining and further development. This, of course, is a safe business—not always good business—but it brings about a situation that ought to be analyzed.

The developer must sell his ore as mined. If he cannot do so, he has to stop. This places in the hands of the mining departments of the smelting firms the control of the ore production of the country.

A property, under the independent operator, producing a certain tonnage with reserves blocked out, is acquired by the mining department of a custom smeltery. The next steps are as follows:

Its production is forced to all it will bear, and the ore reserves are exploited; and often when the next option payment is due, no development has been done, the reserves are about exhausted and the mining department returns a deteriorated property to the original owner. To take care of this forced production, one or more independent producers whose contracts expire or who have been shipping without contract find they cannot get a renewal or are notified that no further shipments will be accepted; hence the closing down of the properties. Their only recourse then is to option or sell to the mining department of the smelting company at their figure, the properties thus forced out of business. This again leads to another condition through which the smelters acquire control of metal production.

It may be broadly stated that every mining property acquired or controlled by the smelters means a closing down of one or more independent producers. In other words, we are in a vicious circle, the independent mine owners and operators being the center, surrounded by the custom smelters and their mining departments. The inevitable result will be the curtailment of production by the independent mines as well as the discouragement of prospecting and developing of new properties.

This situation will result in placing in the hands of the smelters, which are controlled by two or three groups of extremely powerful corporations, the metal production of the country and, incidentally, its price.

Experience has shown that this is an extremely dangerous procedure for both the consumer and the independent producer of new material. It would be profitable to the mining industry to produce some solution of the problem fair to the smelters, the subsidiary mining departments of the smelting firms and to the independent mine operators, developers and prospectors.

Tucson, Ariz., July 12, 1917. ARTHUR C. WHEATLEY.

Professional Mistakes

It has frequently been suggested through the columns of the *Journal* that, since all contributions from operators tell of successes, either in methods or appliances, someone ought to relate his failures. Much could be learned from them. So far as is known, this has not been done. Naturally, many failures have been balanced by success accomplished at the same property during the same period, the negative results not necessarily appearing in the general results in such a glaring manner as would have been the case had the operations been confined to the detail involving the failure. At times justification might be found in the claim that while the work performed was apparently wrong, continuance along the same general lines might have eventually brought success.

If there is a pursuit that lends itself to plausible explanation as to why things went wrong, it is mining. Theory goes wrong, grade of ore falls off; ground caves; things that should have happened, did not happen; things that should not have happened, did. All plausible. The operator hears them from his staff and also at times tells them, and there is no way to prove that the cause is not in absolute accord with the explanation, or that the explanation is not in accord with the cause. The instances of failure noted here are actual ones and can either be admitted or "explained."

A moderate-sized orebody was encountered which, owing to its nature, had to be square-set. Filling costs were high; timber costs were high. Through orders (my own) no more timber was used than was absolutely necessary for safety and the stope was only partly filled. The result was a collapsed stope, 2500

tons of known ore lost. One thousand dollars expended judiciously might have earned $10,000 from known ore. (The term "known ore" is used here with the hope that the probable ore was not there to make the matter worse.)

That other orebodies, encountered later, made a profit which absorbed this loss does not justify the loss of the stope. The $10,000 is still there, now unrecoverable except at a cost far in excess of its value. Economy is no excuse for this loss, as there was no shortage of funds for the work and no reason for it other than bad judgment. At this same property considerable old equipment was used. First economy was later proved a great expense. Old boilers and hoists had to be replaced at a time when it was most inconvenient.

In a district of many parallel veins, some of which were barren, I became imbued with the idea that a certain vein near moderately profitable workings should carry workable values. Indications were that it was unsafe to cut this vein on account of water contained in the higher levels, where it had been prospected. A crosscut tapped both the vein and the water, and it took a year's profit and more to make up for bad judgment.

In a well-known copper district, where property adjoining the productive center was more or less mineralized, I had the choice of two prospects—one with a good surface showing of zinc, the other with a poor showing of copper. I picked the copper and a "lemon," and a tenth of a million went with the lemon. Half a million dollars profit came with the zinc property.

I was called upon to reorganize and develop a property which, having been operated for years, had been allowed to get into a bad state of repair. Work had never been done in a modern way. The tunnels were small and the shafts crooked; in fact, the property was in such shape that it was extremely difficult to decide what to do. I went to work to rejuvenate the old workings, modify old stoping methods and develop new territory. The development went fairly well; the modification of methods went worse well, while the rejuvenation went, Oh — well, and the money, close to $200,000, to — well!

When some of our fortunate operators are telling of their successes, they forgot to tell of their reverses, losses and blunders. Since this letter is written about blunders, there will be no compensation in the way of giving good results obtained. To continue: What is the cause of failure? Is there any basic cause for the bad judgment frequently displayed in mining operations? There are three underlying and unexplainable causes that produce the effect—snap judgment, poor judgment and no judgment.

Snap judgment is the forming of an opinion without the necessary data or information to justify it, and at the same time requiring an over-amount of evidence *in contra* to alter it. As examples: Mistrust of a claim and owner, absolutely a stranger, of whom one has no knowledge other than outward personal appearance, will often start an opinion that is hard to dispel and may operate against a favorable consideration of a prospect or mine. Dislike of a certain district, weather, accommodations, climate. Overestimation of one's own ability to do something a little better than the other fellow did it, or make good where he failed, before going into the details as to why he failed, or by making a comparison of what you know you can do under one condition against what you do not know that you can do in another.

Poor judgment is poor analysis of abstract data, in selection of methods, employees, materials, etc. Many times poor judgment might be considered as ignorance or ignorance as poor judgment—the resultant from either is likely to be the same.

No judgment is a subject that requires no discussion.

It is rather unusual to consider failures, therefore the classification is difficult. It is a question whether to begin with "no judgment" and ascend to "snap judgment," or to begin at "no judgment" and descend to "snap judgment." Perhaps "poor judgment" should be at the top or at the bottom. There are six ways to write the three classifications, and there are about six ways of applying each classification. In my own case, I think that the three classifications can be applied in the six ways to each of the cited failures, blunders or disasters that I have confessed.

Do not think that the mistakes or blunders cited are all that I have made. They are only a few of them, and please do not, everybody who has had about the same thing happen at their property, say: "Yes, that was ——," for perhaps it wasn't and that would be "snap judgment." If you really want to know, if you will write to the editor, he can tell you, but like the Chinaman in Mexico who was beaten by a bunch of revolutionists for yelling *"Viva Huerta,"* and then by the *Huertistas* for yelling *"Viva Villa,"* when asked the next time *"Quien Viva?"* answered, "You holler first."

R. E. MORSE.

St. Louis, Mo., July 14, 1917.

The Corocoro Mill, Bolivia

In the *Journal* of June 16, 1917, in an article entitled "The Proposed Corocoro Mill, Bolivia," by Mark R. Lamb, I note that the author in his remarks on the native copper ores at Corocoro, makes the following statement: "In order to give an idea of the facility with which the native copper ores are concentrated as compared, for example, with the native copper deposits of Lake Superior, I would hazard a guess that a ½% ore at Corocoro would be more profitable than 3% ore at Lake Superior, taking into consideration the cost of mining and concentration, and this in spite of the fact that Corocoro is a long way from the machinery and copper markets."

Having had charge of some extensive examination work in Corocoro district in 1915-16, in the course of which I spent several months there and went quite fully into the matter of the working costs at the properties of both of the principal operating companies there—the Cia. Corocoro de Bolivia, mentioned in Mr. Lamb's article, and the Corocoro United Copper Mines Co.—Mr. Lamb's opinion is of considerable interest to me, particularly as it is radically different from my own opinion in this regard. I would be greatly interested if Mr. Lamb would state in detail the basis for this opinion which he has expressed.

LEIGHTON STEWART.

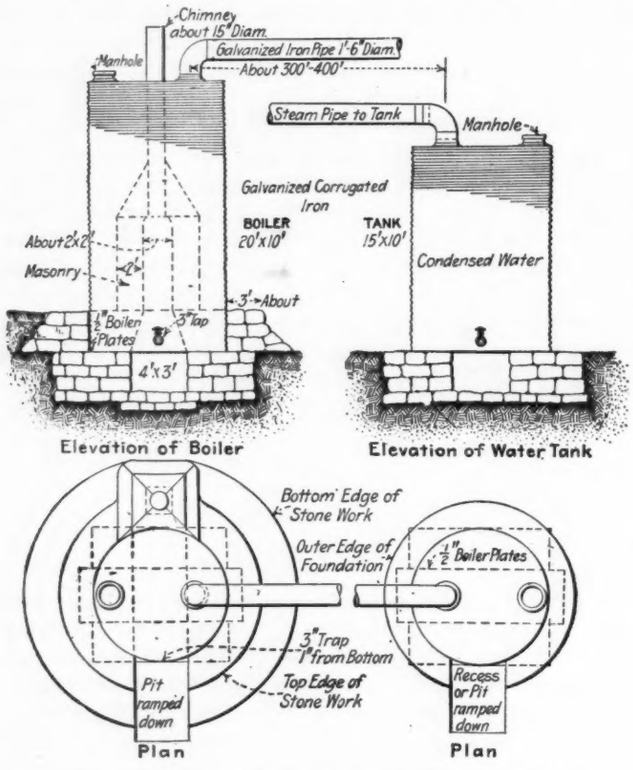
New York, July 10, 1917.

Details of Practical Mining

Condensation of Water at Coolgardie, Western Australia

BY LEONARD GOODDAY
Civil and Mining Engineer, Ottawa, Ont.

In the early days the want of water in the Australian bush was a serious drawback, as the rivers are few and far between. In the gold-mining districts of Coolgardie and Calgoorlie, Western Australia (which towns are about 387 miles east of Perth), where mining was



CONDENSATION PLANT ON COOLGARDIE GOLD FIELDS, AUSTRALIA

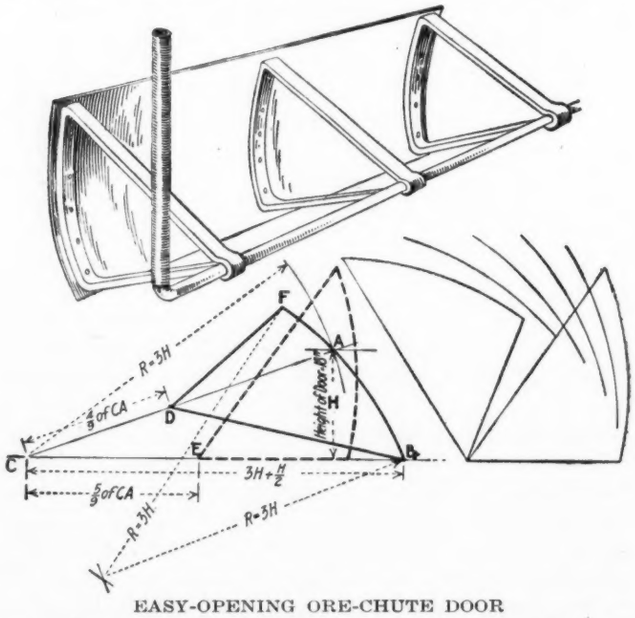
started about the year 1892, water was obtained at depths varying from 60 to 300 ft., but it was in every case impregnated with soluble salts of various kinds, making it totally unfit for domestic purposes, unless distilled once, and sometimes twice. I should say that when lakes in Western Australia were dried up, the beds of most of them would have a layer of about 2 ft. or more of these salts.

Having no means to condense water in the usual way, by allowing steam to pass through a pipe coil in a tank of circulating water, large tanks of corrugated galvanized iron were made from 7 to 10 ft. in diameter by 15 to 20 ft. in height, resting on ½-in boiler plates resting on solid stone foundation, with a furnace underneath the center for burning wood of which there is a plentiful supply.

Referring to the sketch, it will be seen that the condensation of steam is accomplished by means of galvanized piping from 12 to 15 in. in diameter, and having a drop of about 1%, connecting the boiler and condensed-water tanks which are placed 300 to 400 ft. apart; the difference of temperature between the boiling water and the atmosphere (highest in the summer about 180° F., and in the winter 120° F. in the sun, and at nights 60° to 70° F. in the summer to 40° F. in the winter) causing the condensed steam to trickle along this connecting pipe. The furnace, as will be seen, is made right through and connected to a chimney made of masonry and iron tubing, as shown, or with masonry only. The hardwood (gum and jarrah) gives out intense heat for some time. The pit in front is easy of access for firing. The tank is filled through the manhole at top. Two pet-cocks are fixed at the side of each tank for gaging the amount of water in the tanks. Some of the larger mining companies used to sell water to the smaller ones, in which case the condensed water or supply tank would be supported high enough to enable small tanks on trolleys to be backed up for filling. The boiler would be filled up to 4 ft. from the top, which would amount to about 7812 gal., say 35 tons, and the supply tank would be filled to about 33 tons. Water-works were erected about 1900, good water being obtained about 200 miles away.

Ore-Chute Door

The circular door frequently used on ore chutes and ore bins, swinging on a circle, frequently sticks, owing to the cutting and dragging of the sharp corners of



EASY-OPENING ORE-CHUTE DOOR

ore or waste, or the sticking of a talcy material. A door that draws away from the material at the same time that it is raised may be easily made by following

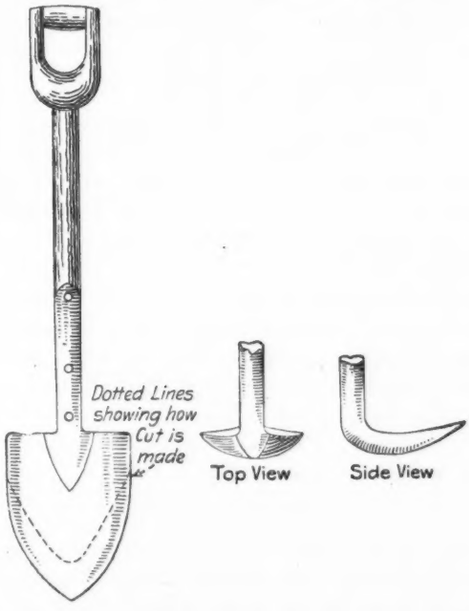
the directions given. Any blacksmith or boilermaker can lay this out in the shop, with a measuring stick and a piece of chalk. Bearings, hangers, lever, etc., are shown in the accompanying sketches.

To describe the arc for the door, take as an example a door 18 in. in height. From the point *C* on a horizontal line describe an arc taking as radius distance three times the height of door (18 in. × 3 = 54 in.). From the point *C* mark off the point *B* on horizontal line 3½ times the height of door. Run a line parallel to the base at the height of door, and at the intersection with the arc fix the point *A*. Describe an arc from *B* through *A* with the original (54 in.) radius. Extend the arc beyond *A* for a distance equal to 3/2 *AB*, to the point *F*, for height of door. Draw a line from *C* (original center) through *A* 4/9 of distance *C* to *A* = *D* (4/9 equals 1⅓ times the height of bin opening). Five-ninths of *AC* = *E*, point of swing of gate. The door will now be arc *FB*. Bracing will be *DF* and *DB*. Reverse the door, placing center *D* at the point E. With *B* up and *F* on chute bottom, the door will then open on the arcs as shown.

A Use for Old Shovels

BY D. E. CHARLTON*

There is scarcely a mine or mining district where an accumulation of old shovels cannot be found either on the scrap heap or in old drifts and stopes, and that these can be put into practical use has been clearly demonstrated. In the well-established districts many of the



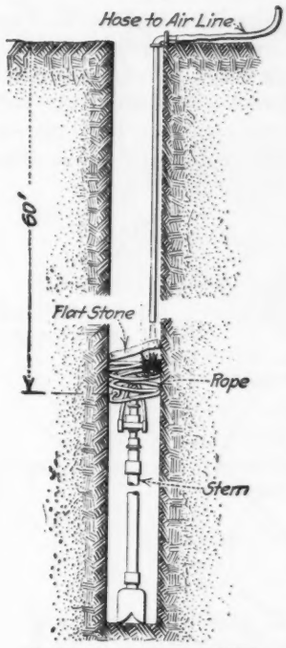
FARMING IMPLEMENT FROM AN OLD SHOVEL

companies have encouraged their employees to plant gardens, and during this year the practice has received a decided impetus owing to the possible food shortage and high prices.

The much despised, worn-out "No. 2" offers the "makings" of an excellent hoe for garden use, particularly where the soil is heavy and requires considerable cultivating. The mine blacksmith can cut the worn edge to a V-shaped point and in one heating can bend it over. If a sharp cutting edge is required, a few minutes on a grindstone will suffice, and the carpenter can easily supply a suitable handle. It is best not to attempt tempering, as the steel has a tendency to split, but slight cooling and then immersion will secure the desired effect.

*Virginia, Minn.

Removing a Rope from a Drill Hole



BURNING OFF ROPE FROM LOST DRILL BIT

A NOVEL method of recovering a lost drill stem is described by H. S. Carpenter, of Billmyer, Penn., in *Engineering News-Record*. During operation the drill rope broke when the stem was about 60 ft. down, and a loose flat stone apparently fell right on top of the coiled rope and prevented reaching it with a spear in the usual manner. Kerosene was then poured into the hole, and a piece of ½-in. pipe, attached to the air line, was lowered over the rope as shown in the sketch. A piece of waste was then ignited, dropped down the hole and the air turned on. The accelerated flame soon burned off the rope, and the stone slipped down beside the stem, permitting easy recovery of bit with usual fishing tools.

Proper Tension for Steel Tapes

BY ALFRED K. FRIEDRICH*

Everyone knows correct measurement of distance is just as important as correct bearing, but far less care is usually employed than in measuring angles.

Most tapes when they come from the factory are correct at a 15 lb. pull when supported their entire length. Now, this condition is almost never met with in the field. The proper tension when unsupported is what the engineer usually desires. I made some tests recently that may be of general interest:

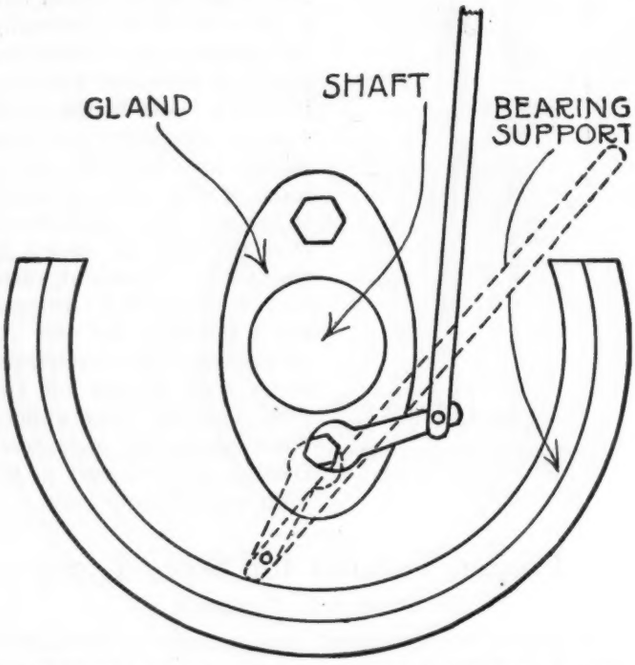
I first laid out 100, 200 and 300 ft. with a standard tape. This was done on a piece of perfectly level ground. Wooden hubs were driven flush with the ground and a scratch made at the graduation points in order to have as fine a mark as possible. I next laid out the tape to be tested (300 ft. in length), and found it correct at a 16-lb. pull. I next tried the tape unsupported. Lifting a 100-ft. section clear of the ground, I found it correct at 32 lb. In the same manner 200 ft. was correct at 48 lb. From these results I expected the 300-ft. total to require 64 lb., and was rather surprised to find that it only required 56 lb. to pull it up to the mark when entirely unsupported. The tensions were all less than I had expected to find them, as I was using an extra-heavy tape.

*Carmichaels, Penn.

Mining and Metallurgical Machinery

Wrench for Special Uses

A special wrench and its use is described by M. Papworth, in *Power*. On one turbine there was considerable trouble with the carbon packing rings, so we substituted a casing, forming a stuffing-box and gland for soft packing. As there was very little clearance left between the gland and bearing support, extending more than halfway round the under side of the shaft, the gland being longer than the original one, there was no room to get at the bottom nut with a wrench more than 3 in. long, so we had to devise some different way to tighten the gland. I cut an "end wrench" off 3 in. from the head and made a handle about 16 in. long, drilled through both and bolted them together, making a swing joint. This prevents burning the fingers and makes a handy little wrench that can be used in many close quarters.



WRENCH HANDLE JOINTED TO GO IN CLOSE SPACE

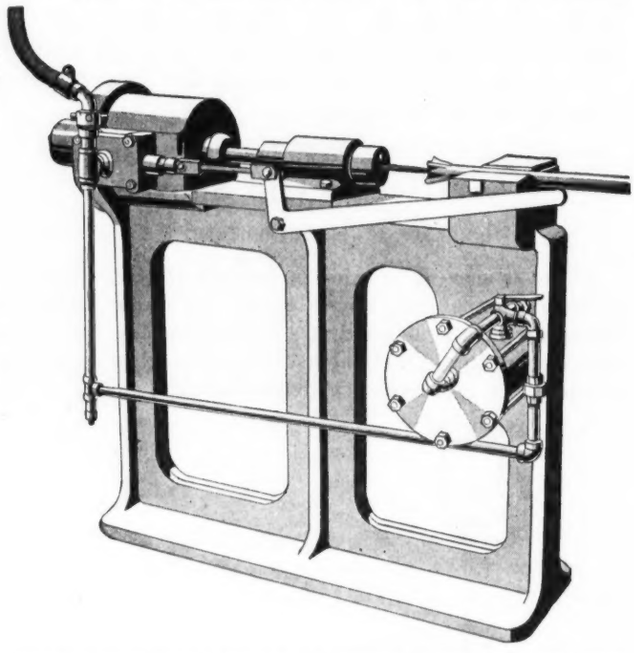
A Punch for Hollow Drill Steel

A machine designed to meet a growing demand for a process that will quickly and satisfactorily open up the holes in bits and shanks of hollow drill steel is being placed on the market by I. H. Proske, Denver, Colo. With this puncher the hole can be opened and enlarged in an instant. A powerful griping jaw to hold the steel is provided, and the punch is rammed into the hole, and pulled out again, the grip being powerful enough to hold the steel.

The operation is done so quickly that the steel loses very little of its heat in this operation, and the work is done very much more satisfactorily than can be performed by hand labor.

An auxiliary extension cylinder on the backhead of the punching cylinder provides a cushion to prevent the piston striking on the return stroke.

This machine is rigid and massive enough to stand up to the work it has to do. The punches can be taken out and exchanged in an instant. A four-way valve operates the gripping cylinder; all the operations are very simple and handy so that no time is lost, and the character of the work is good. The net weight is about 1200 lb.



PUNCH FOR HOLLOW DRILL STEEL BITS AND SHANKS

Tube-Mill Lining

A tube-mill lining carrying 94% silica, 2.4% hydrate of alumina and potash, 2% hydrous silicate of lime, 1.6% oxide of iron, and having a crushing strength of 45,300 lb. per square inch is being mined and placed upon the market in standard blocks for tube mill linings by the Jasper Quarry Co. of Sioux City, Iowa.

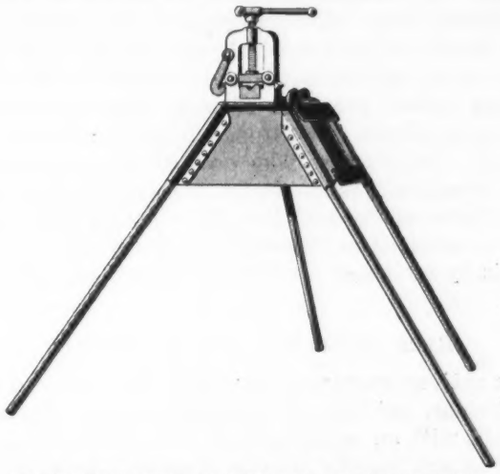
Tests show the abrasion of this material to be 4.6% by standard rattler test, with a coefficient of 21.5.

This is equal or superior to the material formerly imported and now unobtainable on account of the war.

The imports of silica for mill linings will probably never reach anything like their former operations, as we have deposits in this country equal to all demands.

Portable Vise Standard

A portable vise standard and pipe bender that is being used by many water companies for service work and described by *Engineering and Contracting*, is made of No. 16 sheet iron thoroughly riveted and braced with angle irons. The legs are made of ¾-in. pipe, which slip into sockets when the stand is set up. The stand is equipped with a vise for holding pipe when cutting



PORTABLE VISE STAND FOR PIPE CUTTING

or threading. The bending device during these operations acts as a guide and rest for the pipe. It will bend pipe or conduit from ⅛ to ¾ in. in diameter. It weighs about 45 lb., is easily transported and when set up is perfectly rigid. The device, manufactured by H. P. Martin & Sons, Owensboro, Ky., is shown in the illustration.

A Pulverized Fuel Feeder

In the cement industry of this country, representing a total investment of $250,000,000 and producing 100,000,000 bbl. of cement annually, over 6,000,000 tons of coal is consumed in the kilns, under very wasteful and inefficient conditions. In order to prevent this waste, the Locomotive Pulverized Fuel Co., of 30 Church St., New York, is placing on the market a combined feeder and commingler, details of which are shown in the illustration. This feeder will deliver from 3000 to 4000 lb. of coal per hour, consuming only 5 hp. against 150 to 160 hp. required by the blast delivery now in common use at many plants.

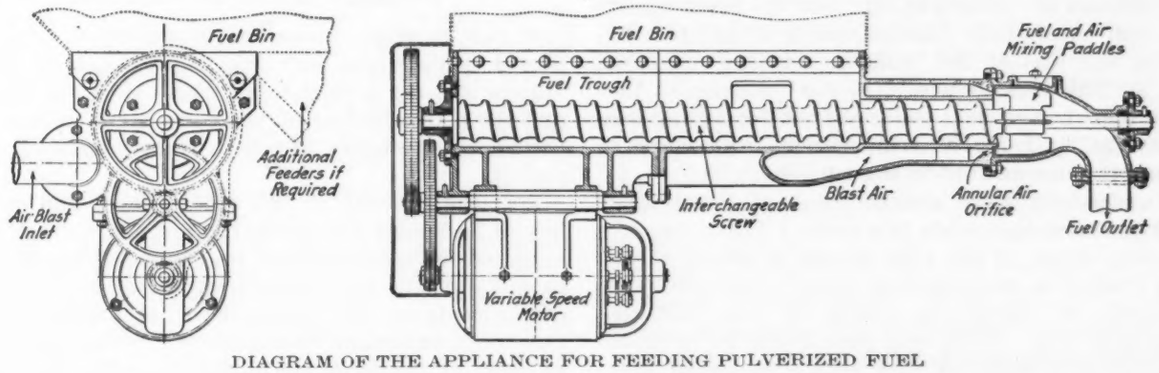
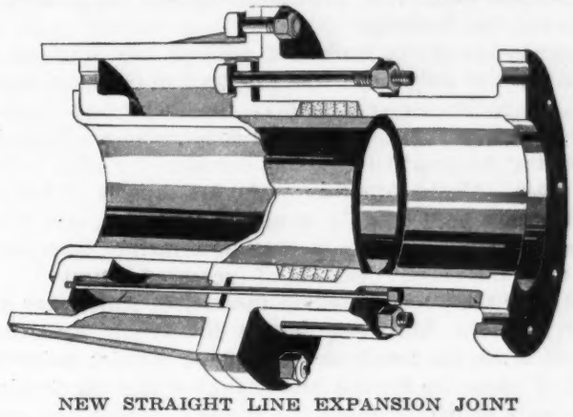


DIAGRAM OF THE APPLIANCE FOR FEEDING PULVERIZED FUEL

A New Expansion Joint

An expansion joint, manufactured by the Ross Heater and Manufacturing Co., of Buffalo, N. Y., uses a flange, machined to a sliding fit within a similarly machined cylinder in order to maintain perfect alignment.

The packing gland can be drawn up from the outside, without disturbing any point of the joint proper.



NEW STRAIGHT LINE EXPANSION JOINT

Two single types are made, with traverse of 4 and 8 in. respectively, and two double types, having 8- and 16-in. traverse. The joint fits between standard flanges.

Decalescence-Point Finder for the Blacksmith Shop

As stated in George H. Gilman's article, "Drill Bits and Drill Steel for Metal Mining," published in the *Journal* of May 12, the proper heat for plunging a drill for tempering, regardless of the carbon content of the steel, is when it loses its magnetism. This temperature is known as the point of decalescence.

The Slocum, Avram & Slocum Laboratories, Inc., of 531 West 21st. St., New York, have placed on the market a decalescence-point finder which consists of a highly sensitive, carefully balanced magnet that may be suspended upon an extension arm over the forge, making it unnecessary to take the drill from the fire while determining whether the point of decalescence has been reached or not, although it is better to do so, as the magnet itself will be demagnetized if allowed to become too hot. The loss of magnetism may be overcome, however, by remagnetizing with an appropriate magnetizer which may be attached to any direct-current electric-light socket.

The Flat River, Mo., Strike

By H. A. Wheeler
Consulting mining engineer, 408 Locust St., St. Louis, Mo.

There is now little doubt that the recent strike in the Flat River lead district in southeastern Missouri was inspired and carried out by parties in the employ of the German war machine in their efforts to cripple the American industries, especially the two basic ones, of mining and farming.

When the strike broke out without any warning on the night of July 14, it was supposed to be the outburst of the native Americans over the increasing employment of foreigners, as only the latter were available for meeting the greatly increasing demands for labor in this district. All the Americans who are capable of holding a job have been steadily employed for years, and it has been necessary to ship in outsiders, mainly foreigners, to meet the urgent demands of increased activity.

Under the guise of calling themselves Americans and carrying the American flag at the front, the armed mobs drove the foreigners out of the district under the cry of "America for the Americans"—"that the foreigners were depriving them of a living." There was some "roughhousing" and beating up, with a liberal amount of shooting, but the latter was mostly in the air. The generous display of arms, the extensive shooting—although it was in the air—and the seeming unanimity of the large mob of natives sufficed to scare the foreigners so badly that most of them hurriedly left the district, many even abandoning houses and gardens that they had enjoyed for years.

After boasting of the success of their efforts, as "Americans," in running out the foreigners, the mob had the effrontery to applaud themselves for the humane methods employed and the slight amount of blood that was shed.

Ample Work for All, American Workmen Not Being Replaced by Foreigners

There was no question of wages, hours or unionism involved, and there were far more vacant jobs than men to fill them, while wages were never so high, as the miners are making $4 to $6 a day. It seemingly was a pure outbreak of "Americanism," and the press reports were most successfully manipulated to create this impression and that of the "humane methods" employed with "so little loss of life." It was "Americans protecting their homes and livelihood from foreign aggression," with "no I. W. W. complications," according to the reports disseminated to the outside world.

To understand more clearly the local situation, it should be stated that when this district began its present active career, at the close of the Rebellion, it was in the heart of a bushwhacking country and was made up entirely of Americans—mostly of the Tennessee mountaineer type. While very poor, living in log cabins and abominably underfed, they were a contented, easy-going lot who were remarkably independent and had to be handled with soft gloves to keep them at work. The 90c. to a dollar a day for surface hands and $1.15 for miners were big wages—more money than they had ever before received, and they were well paid, considering their low efficiency. Better housing, better living and increasing competition for "public-works jobs," as the natives call company work, improved their efficiency and wages increased.

With the rapid development of the district that started about 20 years ago, the supply of natives was simply inadequate, and the more recent employers were less tolerant of the slow, easy-going, highly independent character of the natives. Outside labor had to be shipped in, mostly Hungarians, and with the rapid growth of the district, their numbers have greatly increased. As the Hungarians were husky, strong, willing fellows, they were assigned to the shoveling and other heavy work, for which they were decidedly superior to the natives, but lately, especially since the contracting system has been adopted, they have been advancing as miners. The Hungarians were thrifty, satisfactory, hard workers who clanned by themselves and while occasional family squabbles occurred from indulging in too much "booze," they never bothered the Americans or indulged in shooting scrapes, which latter pastime is by no means a thing of the past among the natives.

Race Jealously Always Present

The natives resented at the outset the intrusion of the Hungarians, but beyond noncomplimentary discussions and talk, with an occasional wild pistol shot, it never resulted in any serious trouble, especially as at first the Hungarians were confined to the despised shoveling, which is too strenuous work for the average native. While the increasing number of foreigners created more talk among the natives, they would never have attacked them, as they recently did, of their own volition if no outside influence had not inspired, organized and led the cowardly outrages that were mainly perpetrated at night on the inoffensive foreigners. Having known this district for over 30 years and seen it emerge from the bushwhacking stage, I know whereof I speak, and while the natives have always resented the presence of the Hungarians, their objections were passive, as they have always lacked initiative and leadership; but the latent feeling has always been there for starting an uprising, if extraneous sources would furnish the initiative and leadership.

Outbreak Incited by Strangers

It now develops, under the investigation being conducted by the grand jury, that many strangers silently slipped into the district a few days before the outbreak and the active leaders of the mobs seem to have been exclusively strangers who have since completely disappeared.

Someone knowing of this race jealousy and of their lack of leadership and nerve, has taken advantage of the situation to furnish leaders, brains and sufficient money to win over the few flannelmouths that every working center contains and temporarily has heavily crippled this most important lead-producing center by scaring off most of the large and highly essential foreign element. There are some local complications, as usual, which more or less obscure the cause of the outbreak, but if the matter is later thoroughly threshed out, it will undoubtedly result in the discovery of a few agents of the "Devil Maximus," to whom should be donated a few ounces of Flat River lead through the medium of the firing squad.

Editorials

The Matter of Prices

THERE seems to be some prospect now that the business of buying supplies, both for the United States and the Allies, together with the matter of prices, will be coördinated by the newly created War Industries Board. That board comprises Frank A. Scott, chairman; Lieut.-Col. Palmer E. Pierce, representing the Army; Rear Admiral Frank F. Fletcher, representing the Navy; Hugh Frayne, a labor leader; Bernard M. Baruch, Robert S. Brookings and Robert S. Lovett. Herbert C. Hoover, although not a member of the board, will sit with the purchasing commission in cases where the purchase of foodstuff is involved.

It is understood that Mr. Baruch will be the chief purchasing agent for raw materials and Mr. Brookings for finished products, while Mr. Lovett will have charge of questions of priority. No policy has yet been declared, but Washington dispatches have talked about making the same price for the United States and for the Allies.

There is ground for satisfaction in that this matter is to be removed from the fog of ignorance, politics-playing and vacillation, in which it has been shrouded in the departments. There is further ground for satisfaction in that the purchasing committee is composed of men of decision, experienced in business affairs, even if the personnel be not ideal. We have no doubt that this committee will be governed by the idea of maintaining maximum production, above all things, and will agree with the producers as to prices, which prices will probably be changed from time to time. In other words, there will be a deference to the law of supply and demand, but the buying will be collective and squeezes due to foolish and unrestrained grabbing for scant supplies will be checked. The investigations by the Federal Trade Commission will probably be carried on to save the faces of some of the officials of the Administration who have made such a mess of things, but its advice will not amount to anything.

In the meanwhile a contract has been made with the committee of lead producers for 25,000 tons of lead, to be delivered during August, September and October, at 8c. per lb., the same price as for the July contract. The purchase of round lots of high-grade spelter having recently been made at 13@13½c. through the zinc committee, the latter has been requested to ask for bids on 5750 tons of prime Western spelter, f.o.b. St. Louis, to be delivered during the next 10 months. The zinc committee was authorized by the Secretary of the Navy and the Secretary of War to accept the lowest prices. This is a return to the old practice of the Government buying on lowest bid.

Thus, the Government is obtaining its supplies of lead and zinc without any great fuss, the snags being only in the cases of steeel and copper. As for copper, this is rather funny, for among the major metals it has been the one that has exhibited the least extravagance, all things considered, and at present is relatively lower than cotton or wheat. However, it may be prophesied that the true situation in this important industry will ere long be recognized.

Cost of Producing Copper

IT MAKES all the difference whose ox is being gored. Until recently, the managements of most of the copper-producing companies took the greatest pride in showing how cheaply they could produce copper. The brokerage houses, interested in promoting movements in the stock market, went the managements better, while the financial papers capped the climax with their tables of alluringly low costs and wonderful profits computed therefrom at a scale of prices for copper. But since the cost of producing copper has appeared likely to be a factor in the determination of price for the metal under Government control, all members of the old chorus have been singing in a different key. The producer who not long ago was blithely alleged to be making copper at 10c. per lb. is now lugubriously represented as being subject to a cost of 19 or 20c. Wherefore the remarkable change of tune? That question will doubtless be asked by some Senator from Missouri, who will find plain equivocation in the high figures talked about today.

Not so, dear Senator, the equivocation was in the low figures of yore. We are able to say this with some grace, inasmuch as for many years we have charged that many famous copper-producing companies did not really produce at such low figures as they represented, our intimations to that effect usually drawing out a cloud of brickbats. In what ways were the old figures, even those officially reported, misrepresentations? In a great variety of ways.

In the first place, companies reported figures analogous to the cost of running an automobile on new tires. In other words, there was not proper allowance for repairs and renewals. In the next place, expenses that properly belonged to repairs and renewals were often charged to capital account, where they were forgotten by the stockholder who merely examines reports from year to year, although the treasurer never forgot about them when he was called upon to supply cash for the payment of dividends or other purposes. This is one reason why dividend disbursements constitute only a percentage of what a copper-mining company has been earning apparently. There are few, if any, companies that have allowed for the amortization of the plants

that they have been wearing out or depreciating in other ways. The way that works is that a company after 10 years or so finds that it needs a new mill or smeltery and then has to cease paying dividends until the new plant is paid for.

Another common way of misrepresenting things has been by giving the mine credit for the earnings on large sums of capital invested in railways or other branches of business. In some cases the railway is used simply for the transportation of ore from the mine to reduction works, but in many cases mining companies operate railways not only for the transportation of ores and metallurgical products, but also for a general carrying business. Thus, the Nevada Northern of Nevada Consolidated, Bingham & Garfield of Utah Copper Co., Mississippi River & Bonne Terre of the St. Joseph Lead Co. In many cases the earnings from such railroads are deducted from the cost of producing copper. In some cases this interrelation between mine and railway may be the subject of hocus-pocus. Sometimes there is opened an ore deposit in a remote part of a rough country, which ore deposit becomes valuable only when a railway is built to bring out the product. Sometimes such a railway must be built through a country that has no other immediate resources to speak of. The cost of producing copper from such a deposit must, therefore, include the cost of the railway. However, it is a common practice to have one corporation for mining and another corporation for railway building and operating. The promoters of such a concern may give things a decidedly different look according as to whether they choose to figure a cheap mine and a dear railway, or vice versa.

Another fallacy in the matter of costs pertains to those mines that produce valuable substances other than copper. Most of the copper producers work ores that yield a little gold and silver. It is the common practice to deduct the value of such byproducts from the cost of producing copper. So long as that does not amount to much, and so long as it is the common practice among producers, there is no great misrepresentation. When, however, the ore yields a good deal of value other than copper, there may be a great deal of misrepresentation. Thus, there are some mines whose classification is doubtful. For example, should the mines of the Cœur d'Alene in Idaho be classed as lead mines or as silver mines? At one time their lead value might predominate, at another time their silver value, according to market conditions. Among the copper mines, the Anaconda and United Verde are especially noteworthy for their high silver value, Anaconda being not only the largest copper producer of the United States, but also, with its output of 10,790,705 oz. of silver (in 1916), the largest silver producer. Possibly, in the case of the Anaconda company the matter of determining the cost of copper reaches the climax of difficulty. For that company is not only a producer of copper, zinc, silver, gold, lead, and various byproducts, but also is an operator of custom smelteries and refineries, railways, coal mines, factories of several kinds, public utilities, mercantile stores, etc. The company itself has never attempted to state its cost of producing copper.

Finally, there is the great question of the investor in a copper mine getting his money back; that is, the principal invested in the business, both for the acquisition of the orebody, in the first place, and the subsequent equipment of it with plant. For the latter a factor can be approximated. Experience has shown that the equipment of a copper mine costs about 15c. per annual pound of production, wherefore, reckoning 10 years of use and 7% interest on the money invested, about 2½c. per lb. copper should be allowed on this account. But for amortization of the capital invested in purchase of orebodies, human ingenuity has not yet been able to devise a general rule. In some cases, especially those of flat-lying orebodies that can be delimited by the drill, we can make fairly reliable estimates. But with all other classes of orebodies, like those of Butte, Mont., Jerome, Ariz., and Bisbee, Ariz., nobody can say what is going to be their duration and what should be the annual allowance for depletion.

This is the problem into which the Federal Trade Commission was lightly launched. Its report cannot possibly be anything but a hodgepodge of fragmentary data, which will not be of value to anybody.

The Commodity Committees

THE system of appointing subcommittees for the several commodities among the producers of those commodities was bound sooner or later to invite adverse criticism in Congress. That criticism has been ignorant, malicious and vituperative. A fitting retort is *honi soit qui mal y pense.* None but the evil minded could think of some of the things that have been said. Those who are dishonest in mind cannot conceive how anybody can be honest. No group of more high-minded, sincere, patriotic men could be found than those who head the several committees connected with the mining and metallurgical industries.

Nevertheless, the system is wrong, partly for the way it looks to the public generally which is not well informed, as witness how it looks to Congress, and partly for its destruction of competition—the producers now being practically required to work together. This is a direct consequence of the meddling with natural conditions. There are some things wherein coöperation is absolutely necessary. This would better be brought about through a disinterested metal board. On the other hand, complete separation of interest in all activities of the Government cannot reasonably be expected, as Mr. Rosenwald has pointed out. Active men are engaged in business. If their services may not be employed, we might find it necessary to intrust the great commercial affairs of the Government to backwoodsmen and barkeepers.

It is gratifying that the committee appointed by the Colorado State Legislature to investigate smelting charges in that state has secured the advice of an engineer of the experience of O. R. Whitaker.

BY THE WAY

Russia has her Lenine and her Trotsky. America has her La Follette, her Gronna and her Reed.

Alaska has adopted the eight-hour day, says the *Sun*, but no prospector seeking his fortune will be arrested for violating it.

The Union High School at Bakersfield is arranging to do assaying in its mining department for the accommodation of miners and prospectors, who will be charged a moderate fee. The work will be under county supervision and the direction of W. S. Mills, who is in charge of the mining department of the school.

A distinguished mining and metallurgical engineer, who has long been an operator in foreign countries, found in connection with a search for a certain chemical expert, that he was hard to find. The following paragraph from a letter from him is interesting: "The chemical experts are not like the members of *our* profession. They are hard 'to get on to,' even though 'the woods are full of them. And, I believe, they are all very secretive and not as communicative as our own people; that is, in regard to what they know. I think *we* belong to the noblest minded profession of all the technical 'bunch,' and am mighty gratified that the administrative capacity which mining seems to inculcate is being recognized by this nation in the appointment of such men as Hoover."

A gas well belonging to the Ouchita Natural Gas and Oil Co. and situated about 17 miles west of Monroe, La., became ignited and for six days consumed gas under 1500 lb. pressure at the estimated rate of 30,000,000 cu.ft. per day. William Guerin, of the Pyrene Manufacturing Co., of New York, formerly a deputy chief of the New York Fire Department, who was called in in an advisory capacity, suggested that two streams of water be played on the base of the well casing so that they converged from an angle of 90°. The streams were slowly raised up to and through the column of gas until they reached the base of the flame. The men were ordered to squeeze their thumbs against the stream at the nozzle so as to spread the water in fan shape. This water cut off the flame from the gas, which was extinguished by steam as quickly as the snuffing out of a candle can be accomplished.

How Cecil Rhodes started his mining career is told by John Hays Hammond in the July *American Magazine*. "Ill health dogged his youth; at 17 he was shipped from his home in England to the warmer climate of Natal, where an elder brother was trying to cultivate cotton. A year after the arrival of young Rhodes, diamonds were discovered in Kimberley, several hundred miles away. Rhodes decided to join the rush. His oufit consisted of a team of oxen, a Scotch cart, a bucket, a spade, several volumes of classics and the thumb-worn Greek lexicon. In this fever-ridden spot, with poor sanitation and worse food, he worked and brooded and studied, with winter trips to England and Oxford on his scanty savings. One year he was too poor to go. Another year his health failed and the physician told him he had only six months to live. While yet in his teens he formed the holders of several small claims into a syndicate. Always he preached the folly of cut-throat competition. Gradually he began a consolidation, of which he naturally became the leader."

Miss Jeannette Rankin made her first extended remarks in the House of Representatives on Aug. 7. It was regarded as unfortunate as her first vote, which was cast against the war resolution. The "lady from Montana" spoke in defense of workers who have tied up the copper mines in Montana and in criticism of the Government for failing to prevent the lynching of Frank H. Little, an I. W. W. leader. Representative Johnson, of Washington, asked her if she was aware that the I. W. W. workers are anarchists who disclaim allegiance to any government. Failing to obtain a direct answer, Mr. Johnson made the following interrogatory statement at the conclusion of Miss Rankin's speech: "I would like to ask the lady if she knows if these members of the I. W. W. who were responsible for the assassination of the Governor of Idaho some years ago, who threatened to assassinate the Governor of Utah and who threatened numerous other prominent officials with assassination and death and who themselves declared they owe no allegiance to the United States or to any other country, have any right to squeal when citizens of this country hang one of them occasionally?" This question, which evoked loud applause from the floor, was not answered.

The Driller's Troubles

The ground is as hard as the devil,
The steel won't cut at all,
The smith knows a lot about temper!
The boss ought to give him a call.

One piece is as hard and brittle,
The next one's as soft as lead,
If he don't give us stuff we can work with
I'll bend a length over his head.

My partner blocked up like a farmer,
The bar's coming down by the feel,
The air hose and water is leakin',
And I'm most as wet as a seal.

The machine takes oil like a furnace,
And blows it all over the face;
Some son of a gun has swiped my wrench
And left a bum one in its place.

We'll ne'er get the round in by tally,
It's a cinch that the shifter is sore.
If the muckers had gotten the dirt out,
We'd have finished it long before.

The powder and caps are rotten,
The fuse is a genuine fake,
The air is chock full of water,
And the blasted ground won't break.

There's no need in sweating your life out,
This job is awfully tough,
So I think it's time to taper off,
I guess she's in deep enough.

B. A. PRICE.

Hoover Comes to Town*

How Hoover descended on Washington, having sailed for America fifteen days after war was declared. Many mining engineers on volunteer staff of "aids," who, living together on Sixteenth Street, are put on war rations by Mrs. Hoover. The new Food Administrator thinks quickly, acts quickly and gets things done.

NOBODY else—at least it defies the memory to recall a parallel—has ever come to Washington in circumstances quite like those that brought Herbert C. Hoover there. Certainly, nobody who had achieved abroad an international status so conspicuous was ever called upon to make good, so to speak, his reputation for the benefit of his countrymen at home. For in one respect Mr. Hoover is quite unlike all the other strong American personalities who have come to Washington. He came preceded by no illustrious achievements in city or state of his own land, but with a record and experience obtained across the seas, esteemed alike by the statesmen of Germany, England and France, modest but aggressive, bluntly assertive when necessary, a dynamo of human energy—a genius in executive organization.

"Belgian Relief" Efficiency To Be Applied to the Distribution of America's Food Supply

Therefore in Hoover's descent on Washington is a story which, regardless of what its sequel may be in the vicissitudes of food administration, must be included in the inner history of this war. How he found bewilderment and indecision in the early days of our entry into the war—earnestness, to be sure, and a good intent, but a lack of direction, peace-time speed and peace-time modes of thought; how he quickly won the sympathetic attention of President Wilson—the factor of propulsion that soon meant headway; how the newcomer of European experience drew about him strong men, tried and tested, men he had known for years, men who had worked with him on the Belgian Relief Commission and who knew, therefore, the serious side of war, men who talked his own language of executive action; how he was puzzled at first and impatient as the novice over the irritating delays of Congress, the personal attacks—all this is a travail analogous no doubt to that of many another organization in embryo, but it means the birth of a great movement that must ultimately contribute incalculable war strength to the nations aligned against the Central Powers.

"Food conservation" and "increased production" are no longer mere phrases of agricultural parlance. They mean supplies for the greatest armies that have ever been mobilized by the united democracies of the world. They mean that the great American granary is being unselfishly opened to the kinsmen and friends across the sea who have been making for nearly three years the supreme sacrifice in defense of principles identical with the tradition and spirit of America.

War was declared on Apr. 6, and Mr. Hoover was promptly called to service by President Wilson. Quickly he arranged for the management of the Belgian Relief Commission, gathered food statistics in England of value to him in future work, and on Apr. 21 was standing on the deck of a liner moving slowly out of Liverpool. The ship was halted outside the harbor by the Admiralty and held there for three days, an exasperating delay to a man anxious to get home to begin the work to which he had been summoned. Finally, the vessel crept out and, passing northward almost as far as the Arctic Circle, managed to escape all dangers, including two submarine mines fastened together by a fifty-foot cable.

No Rest on Landing in the United States

Twelve days of such a journey and one would suppose a man worn out and anxious at least for a good night's sleep on landing in New York. But Hoover didn't stop. He took the midnight train that day for Washington, climbing into an upper berth in a crowded Pullman. Next morning he was having a conference at breakfast with officials of the Department of Agriculture! He had telegraphed them of his coming, and from that morning on, conferences in the temporary offices established in his rooms in the Willard Hotel continued for nearly two weeks, all day long and far into the night. Two thousand letters had accumulated, some referred to him already by the White House and Government departments for reply, others inquiring directly for information about prospective food control, or containing suggestions from the canning trades, the millers, the flour men, and that great army of Americans whose business it is to feed the nation and the world. Hoover had with him only Ben Allen, whom he drafted from the Associated Press Bureau in London, and the stream of callers was stemmed, diverted, and drained by Allen with a suavity typically Californian.

It was from California that Hoover himself came originally before he won fame as an international mining engineer, and about the new Food Administrator are gathered a half-dozen Californians, associated with him at Leland Stanford University, of which he is a trustee, or in the business life of San Francisco. Hoover has picked as assistants the men whom he knows are absolutely loyal and indefatigably zealous for the success not of themselves but of the cause.

"The Chief" Has "Aids" Not "Aides"

There is no rank in the Hoover contingent—all are aids, counsellors, executives. Titles mean nothing, for each is subordinate to the direction and command of "the Chief," as he is familiarly called. First, there is Dr. Ray Lyman Wilbur, president of Leland Stanford University. Wilbur happened to be in Washington attending a convention of college presidents when asked by Hoover to take charge of a department of education on questions of food conservation. Dr. Wilbur knows something about organization himself, and quickly mobilized under the Food Conservation Department some of the finest talent in the country. Many came to volunteer. There was, for instance, Miss Sally Splint,

*From an article by David Lawrence, published in the New York "Evening Post Magazine," July 21, 1917.

of *Today's Housewife*, who brought a suggestion that was promptly acted upon for the mobilization of the editors of women's magazines. From this grew a division on home economies, with several women editors giving four and five days a week to the the United States Government's campaign. Conferences with the editors of farm publications, the heads of agricultural colleges, advertising and publicity men, have been handled by Dr. Wilbur, while Hoover has been busied with President Wilson and Congressional leaders clearing up misunderstandings over food legislation.

To Dr. Vernon L. Kellogg, who was in charge of the Brussels office of the American Commisson for Belgian Relief, a professor of biology at Leland Stanford, was given the task of keeping in touch from Washington through the American diplomatic service with the latest work of the food controllers in Europe.

MINING ENGINEERS CALLED BACK TO THE STATES

Another thing with which Mr. Hoover wanted to keep in constant communication was the neutral relief committees of Belgium. Edgar Rickard, a mining engineer from California, who was drafted by Mr. Hoover in London to be secretary of the American Commission for the Relief of Belgium, was called to Washington to cooperate with W. L. Honnold, director of the London office of the American Commission, in relieving Mr. Hoover of much of the work delegated to him by the British government in directing the expenditure of funds for the feeding of the Belgian people. Mr. Honnold also is a mining engineer, among the best known of Americans in South Africa.

Hoover, it will be seen, picked mining engineers—friends and associates in the big job of Belgian relief abroad. But he found other ready volunteers, too, on this side of the water. All have caught the spirt of energy which shoots through the Hoover personality. And they work together smoothly and enthusiastically. Hoover has rented a big house on Sixteenth Street for his staff. They live together and discuss over the dinner table each night the whole job to a part of which each has applied himself during the day. To Mrs. Hoover must be given the credit for the organization of the Hoover "kitchen cabinet." Men may know a lot about food conservation, but for picking a good house amid the real-estate sharks of Washington, the shrewdness of a woman was needed. And Mrs. Hoover smilingly put the household of a dozen or more on rations.

As yet the organization of the food bureaus is not complete. But the principles of the Hoover plan are virtually established. His success already in persuading the heads of the various food industries to fix reasonable prices gives him confidence that while possessing broad powers he never will be required to use them. Indeed, the organizations of the various trades have come forward with suggestions for price arrangements involving a much more drastic regulation of themselves than could possibly be obtained from Congress.

The National Capital is full of commissions, those that agree once in a while and get things done and others which are dominated by a single mind who might have better been named executive in the first place. Hoover is a commission in himself. He thinks quickly and acts quickly. That is why there have been revolutionary things done in Washington since Hoover came to town.

Chronology for Mining for July, 1917

July 1—Strikes at copper mines in various parts of country started by I. W. W. organizations, especially at Clifton, Morenci, Miami, Globe, Bisbee and Butte.

July 5—Federal troops sent to Globe, Ariz., to prevent Austrian strikers from interfering with pumpmen and others endeavoring to keep copper mines open.

July 12—About 1000 I. W. W.'s interfering with miners working in Bisbee district, Arizona, were deported by Sheriff Wheeler, assisted by Citizens Protective League—Governor Campbell of Arizona requested President Wilson to send Federal troops to preserve order in Clifton, Morenci, Bisbee, Jerome, Humboldt, Ray, Ajo and in Mohave County—Conference of steel men and Secretary of Navy, Secretary of War and Bernard M. Baruch, chairman of raw-material committee, agreed upon plan to have Government fix price of steel.

July 13—M. A. Hanna Co., of Cleveland, Ohio, leased large area of Great Northern ore lands.

July 14—Rioting between Americans and foreigners occurred in Flat River and other southeastern Missouri towns, native miners refusing to permit foreigners to work in the lead mines.

July 16—Montana Power Co. and mining companies on one side and Metal Trades Council and electrical workers on other side reached agreement and concluded terms satisfactory to both, but no agreement made with I. W. W. miners' union, though most of the mines have worked on day shift and are gradually increasing their forces.—Price of silver reached 81¼c. per oz., highest price in 25 years.

July 18—M. A. Hanna Co., of Cleveland, Ohio, purchased Pennsylvania R.R. Co. coal lands.

July 20—Strike of miners in Leadville district occurred, resulting in shutting down of mines.

July 26—Explosion in No. 12 colliery at New Waterford, N. S., belonging to Dominion Coal Co., of Sidney, killed 62 miners.

July 30—Iron miners on Gogebic range in Michigan struck, following I. W. W. agitation.

July 31—Commandeering of iron mines of Cumberland and Lancaster Counties by British Minister of Munitions announced by U. S. Consul General Skinner, of London.

The Determination of Silica

In the article written by H. A. B. Motherwell and published in the *Journal* of June 30, 1917, Mr. Motherwell is reported as saying at the top of column 2, page 1155, "the SiO_2 loss increases with the amount of silica present." This is an error. The reading should be "the SiO_2 loss decreases as the amount of silica present in the sample increases"; that is, proportionately the more SiO_2 present the less the loss.

Continuous Drum Filters

In the article by Carl J. Trauerman on drum filters in the *Journal* of July 14, 1917, one of the figures on page 87 was reversed through a typographical error. In the table the last figure under the heading "Filtered Dry Tons" should be 105 instead of 051 as published.

Personal

C. M. Weld, of New York, will be in Cuba for a month.

R. A. Hardy has been appointed manager for the Montana Mines Co., at Ruby, Ariz.

E. H. Gary left New York on Aug. 2 for Alaska, where he will be for several weeks.

George A. Packard is spending two months in the West in Colorado, Arizona and Nevada.

E. L. S. Wrampelmeier has resigned as manager of the Montana Mines Co. at Ruby, Ariz., and is now at Tucson.

J. M. Boutwell, consulting geologist of the Cerro de Pasco Copper Corporation, is in Peru on professional work.

D. H. Walker, formerly with the United States Geological Survey, is now with the Nevada Chemical Co., Tonopah, Nevada.

George S. Weinberg, of the Engineer Officers' Reserve Corps, will leave soon for Russia on a three months' leave of absence.

Kosaku Yamada, a mining engineer of Japan, inspected the Goldfield Consolidated mines and mill recently at Goldfield, Nevada.

S. W. Eccles of New York, vice president of the American Smelting and Refining Co., was in Spokane recently, accompanied by Mrs. Eccles.

George A. Tweedy, formerly at Rosario, Mex., has gone to Honduras to examine the old mines at Opetika in the department of Comayagua.

Edwin E. Chase has been examining gold properties in the new Herb Lake district in northern Manitoba. He will return to Denver about Aug. 11.

Guy J. Johnson, safety engineer of the Alaska Treadwell company, has accepted a similar position with the Homestake Mining Co. at Lead, South Dakota.

Alvin B. Carpenter and **E. E. McIntyre**, mining engineers, have changed their address to the Citizens' National Bank Building, Los Angeles, California.

E. F. Larsen, of the Geological Survey, is helping Frank L. Hess in a study of tungsten, vanadium, molybdenum, nickel and other metals used to harden steel.

Braxton Bigelow, an American mining engineer serving as captain in the Royal Engineers was wounded in a raid on the German lines on July 23 and is reported missing.

Arthur C. Terrill, professor of mining engineering at the University of Kansas, is spending several weeks in the Kansas-Oklahoma zinc field for the Kansas Geological Survey.

Harry J. Wolf, of the Malm-Wolf Co. of Denver, has completed mine examinations in San Juan and San Miguel Counties, Colo., and has gone to St. Louis on professional business.

A. W. Hudson, of the Phelps-Dodge Corporation research staff, has moved to the Burro Mountain Copper Co. branch at Tyrone, N. Mex., to make some large scale experiments for the company.

F. W. Denton has resigned as general manager of the Copper Range Co., but continues as vice-president. **William H. Schacht**, assistant general manager since 1911, becomes general manager succeeding Mr. Denton.

E. C. Harder sailed from New Orleans on Aug. 3 for Panama, en route to Rio Janiero, where he is due Sept. 1. Private business connected with his iron properties in Brazil occasions the trip. He expects to resume his research work on Minnesota iron ores some time in October.

Major Peter N. Nissen, inventor of the Nissen stamp and later of the Nissen hut, who is well known to engineers in North America, has been promoted to the rank of lieutenant-colonel in the Royal Engineers and is at present stationed at general headquarters in France.

W. R. Appleby and **Edmund Newton**, both of the Minnesota School of Mines, have been in Washington conferring with the directors of the Bureau of Mines and the Geological Survey in regard to establishing coöperative work on the manganiferous iron ores of the Minnesota ranges.

Guy C. Riddell, formerly superintendent of the East Helena smeltery of the American Smelting and Refining Co., is expected to arrive in New York in September from Australia, after a year at Port Pirie as consulting metallurgical engineer during the reorganization and enlargement of the lead smeltery and refinery of the Broken Hill Associated Smelters Proprietary, Limited.

Obituary

Myron Knox Rodgers died in Pittsburgh, Penn., on July 23 at the age of 55 years. He was a graduate of Washington and Jefferson University, of the class of 1886. Upon leaving college he went West where he became associated with Marcus Daly. During this period he examined the Nickel Plate mine in British Columbia. Daly acquired the property, which was subsequently sold to the Hedley Gold Mining Co. Mr. Rogers was largely responsible for the development of the Hidden Creek mine at Anyox, B. C., and was a director and organizer of the Granby Consolidated company that later took over that property. He was a member of the American Institute of Mining Engineers and of other engineering societies. He was interested in educational, church and Y. M. C. A. work and contributed liberally to these causes.

Societies

Chemical, Metallurgical and Mining Society of South Africa held its 21st annual general meeting at Johannesburg on June 23, 1917. Papers were read on the "Construction and Maintenance of Slime Dams," also on "Explosions of Fire Damp and Occurrences of Gob Fires in Natal." G. Hildick Smith was declared elected president, other nominees having resigned.

Industrial News

Byron Jackson Iron Works, of San Francisco, Calif., is erecting a new $100,000 machine shop at its plant at West Berkeley. The new shop will be ready for occupancy about November 1.

Walworth Manufacturing Co. purchased the Kewanee plant of the National Tube Co., located at Kewanee, Ill., on Aug. 1. The National Tube Co. retired from the fittings business on that date.

Receivers of the Aetna Explosives Co., Inc., have been ordered by the United States Court to continue the company's business in all its branches. They will devote particular attention to domestic business and will continue the established Aetna line of dynamites, gelatins and blasting supplies.

Chas. A. Schieren Co., of New York, will start manufacturing immediately in the newly built addition to its tannery at Bristol, Tenn. A force will be employed at the start sufficient to make 24,000 linear feet daily of the highest grade machine belting. This will be increased gradually, as skilled help can be secured, until the full capacity of the plant, 50,000 ft. daily, is reached.

P. H. & F. M. Roots Co. of Connersville, Ind., has brought out a rotary vacuum pump for handling a varying mixture of air, water and steam. The sides of the impellers of this pump are straight and there are no pockets in which water can be trapped which is the unique feature of the pump. It has been successful in heating service and in other fields, such as paper-mill works, where a vacuum of 10-20 in. is required with a discharge head of five or ten pounds.

Pearlman Co., Inc., and the **Clarksburg Zinc Co.**, announce that the United Zinc Smelting Corporation of New York has taken over the ownership and management of their plants located at Clarksburg, W. Va. The United Zinc Smelting Corporation has therefore assumed all outstanding liabilities, obligations and contracts of the above named corporations and all communications hereafter should be addressed to the United Zinc Smelting Corporation, at 99 John St., New York.

Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Penn., has recently received orders for motors for mine hoists aggregating 1350 hp. The largest of these is a 700-hp. motor for a 300-ft. coal hoist at the Inland Steel Co.'s mines at Harmarville, Penn. This hoist will make three trips per minute. On the same property a 200-hp. motor will drive a man hoist making two 300-ft. trips per minute. Other items are: Diamond Coal and Coke Co., Sharpsburg, Penn., one 350-hp. motor; Republic Iron and Steel Co., Youngstown, Ohio, one 300-hp. motor; E. & G. Brooks Iron Co., Birdsboro, Penn., one 200-hp. motor; Mt. Pleasant Coal and Coke Co., Greensburg, Penn., one 200-hp. motor; Valley Smokeless Coal Co., Pittsburgh, Penn., one 200-hp. motor; Eclipse Gas Coal Co., Pittsburgh, Penn., one 150-hp. motor. All the motors are Westinghouse Type CW wound-rotor induction motors with Type F magnetic control.

Trade Catalogs

Messiter Conveyor Scales. Electric Weighing Co., 180 13th Ave., New York. Bulletin No. 10. Pp. 20; 6 x 9 in.; illustrated.

Internal Combustion Locomotives. The Baldwin Locomotive Works, Philadelphia, Penn. Record No. 85. Pp. 32; 6 x 9 in.; illustrated.

Chicago Giant Rock Drill, Tappet Type. Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 137. Pp. 16; 6 x 9 in.; illustrated.

Sperry Filter Press. D. R. Sperry & Co., Batavia, Ill. Catalog No. 14. Pp. 60; 6 x 9 in.; illustrated. Charts showing weights and capacities of the various filters are shown.

Handbook of Conveyor Practice. Robins Conveying Belt Co., 13-21 Park Row, New York. Pp. 96; 6 x 9 in.; illustrated. This contains tables and charts concerning capacities, power requirements, speeds of conveyors, etc.

Oxy-Acetylene Welding, Cutting and Decarbonizing Apparatus. The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. Catalog No. 140. Pp. 36; 7 x 10 in.; illustrated. A new line of lead burning equipment is also shown.

Hoisting Machinery for Industrial Works. Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. Hand Book. Pp. 116; 5 x 8 in.; illustrated. This describes the various types of hoists and cranes and contains tables of dimensions, etc.

New Patents

Aluminum Nitride—Process for the Manufacture of Aluminum Nitride. Ottokar Serpek, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,233,926; July 17, 1917.)

Annealing Furnace—Truck or Stand for Use in Annealing-Furnaces. Thomas Alexander Morris, Llanelly, Wales. (U. S. No. 1,234,789; July 31, 1917.)

Ball Mill — Ore-Pulverizing Ball-Mill. Henry Eggers, Denver, Colo. (U. S. No. 1,235,449; July 31, 1917.)

Bearing Metal—Process of Making Bearing Metals. William H. Kelly, Los Angeles, Calif. (U. S. No. 1,234,547; July 24, 1917.)

Concentrator—Mechanical Mineral-Concentrator. Alfred Molander, Sault Ste. Marie, Ontario, Canada. (U. S. No. 2,235,497; July 31, 1917.)

Electric Melting Furnace — Method and Apparatus for Electrically Reducing Refractory Substances. John G. Webb, Richmond, Va. (U. S. No. 1,234,836; July 31, 1917.)

Electric Smelting Furnace—Cooled Bottom Electrode for Electric Smelting-Furnaces. Martin Sperling, Essen-on-the-Ruhr, Germany, assignor to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. (U. S. No. 1,234,947; July 31, 1917.)

Flotation — Oil-Flotation Concentration Process. Emanuel Wagner, New York, N. Y. (U. S. No. 1,235,083; July 31, 1917.)

Furnace-Charging System. Leslie Douglass Anderson, Midvale, Utah, assignor to United States Smelting, Refining & Mining Co. (U. S. No. 1,234,998; July 31, 1917.)

Furnace Electrodes—Electrode-Packing for Melting-Furnaces. Martin Sperling, Essen-on-the-Ruhr, Germany, assignor to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. (U. S. No. 1,234,946; July 31, 1917.)

Ingot-Mold. Clinton R. Stewart, Johnstown, and George E. Thackray, Westmont borough, Penn. (U. S. No. 1,235,166; July 31, 1917.)

Pneumatic Separator. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. (U. S. No. 1,235,174; July 31, 1917.)

Sampling — Apparatus for Sampling Streams of Wet Ores and the Like. Charles John Williams, Perranwell, Cornwall County, England. (U. S. No. 1,235,090; July 31, 1917.)

Stamp-Mill. Charles M. Mullen and Ray E. Hall, Portland, Ore.; said Hall assignor to said Mullen. (U. S. No. 1,235,149; July 31, 1917.)

Editorial Correspondence

SAN FRANCISCO—Aug. 4

Schedule for Merit Rating California metal mines for compensation insurance, it has been decided, will not be put into effect until a trial rate of practically all the mines in the state has been made so as to be certain that the schedule is practicable before it is made effective. This merit-rating schedule has presented numerous difficulties and has been the cause of much hard work both on the part of H. M. Wolflin, the Bureau of Mines engineer who is assigned to coöperative work with the Industrial Accident Commission of California, and on the part of George S. Rice, the chief mining engineer to whom the schedule was referred for improvements and approval.

BUTTE—Aug. 7

(By Telegraph)

Labor Situation in Butte is gradually righting itself and additional men are reporting for work daily. The I. W. W. trouble is still a factor and its agitators will succeed in holding off permanent settlement. Under I. W. W. influence, smeltery employees of the Washoe works at Anaconda made exorbitant and ridiculous demands on company today, the demands including recognition of the I. W. W. union of the miners and all their demands. The answer they got from Vice President C. F. Kelly was a point-blank refusal and there is little liklihood of the strike spreading to the smeltery employees. Many of the smaller unions are voting to accept the wage propositions made by the mining companies and nearly all of them are refusing recognition and support of the I. W. W. strikers, though some of them are giving money to their strike fund. The strikers, realizing their defeat, are bombarding Washington with telegrams and letters asking for Federal intervention and investigation. The companies have long ago practically conceded every essential demand made by the strikers and the hoopskirt hysteria in the House of Representatives today was due entirely to false information furnished the lady by the I. W. W. and their sympathizers. Statements were made according to press reports that are absurdly false and ridiculous, a fact that must have been known to the Washington authorities who investigated conditions in Butte and had representatives here to look into affairs. It is a well-known fact that if the miners were given protection against thugs who waylay them in going to and returning from work, 95% of the miners would be working today as they are glad to accept the offers made by the mining companies. The street-railway employees suffering from the general infection have gone on a strike under I. W. W. influence and are remaining out although the street-railway company has offered them in many respects more than they asked for. The various craft and workingmen's strikes are not designated "strikes" by them because they have all acted without authority or sanction of their international bodies and so they call it "an individual lockout for vacation purposes." The I. W. W. and other radicals have sought to make much capital out of the lynching of Frank H. Little, the I. W. W. executive-board member, but they have failed in this although they staged a big funeral parade on Sunday for the benefit of the motion-picture camera men who had been engaged for the event. It may be a shameful fact but it is a fact nevertheless that there is general sympathy for and unexpressed approval of the act of the lynching party. A coroner's jury has completed its inquest on this case without finding even a clew to the lynchers.

DENVER—Aug. 4

Leadville's Strike has come to an abrupt termination. To the end, the operators refused any recognition of the union or any suggestion emanating therefrom. This was not in repudiation of the rights of the miners but was the fixed policy of the district's operators who preferred to close down their mines rather than yield, in the least degree, to any demands from organized labor. Last week, no investigation at Leadville having been undertaken by the governor's mediators—Messrs. Rogers and Liddell—appointed the preceding week, the officials of the Leadville union waited upon Governor Gunter and requested the appointment of a third member on the board by President Wilson. Upon learning of this request, the operators "sat tight" and July 30, through George O. Argall, manager of the Iron-Silver Mining Co., sent the governor a long telegram inquiring whether or not his excellency's mediators proposed taking any action, at the same time protesting against further delay and publicly declaring the operators' refusal to enter into any negotiations involving representatives of the union. Meanwhile the operators were holding conferences among themselves and they finally reached an agreement that they were willing to raise wages 50c. per shift. Upon announcement of this decision the miners of the district, union and non-union, met in mass meeting, which continued through the greater portion of last night. Although stormy at times, the net result was the acceptance of the operators' proposition, and the agreement to return to work this morning. The following is the wage schedule under the new arrangements: Miners, muckers and trammers, $4; hoisting engineers on double-drum hoists, $5; on single-drum hoists, $4.50; pumpmen, $4.50 in dry stations and $5 in wet places; men sinking shaft, $5; machine runners, $4.50; timbermen, $4.50; firemen, $4. The district will continue on the "open-shop" plan.

Investigation of Custom Smelting in Colorado proceeds slowly. Since the official investigators are not required to submit reports prior to the convening of the legislature next January, statements of an official nature are not now to be obtained. The legislative committee has thus far canvassed only the mine owners' side of the issue, visiting all the mining districts of the state, obtaining settlement sheets covering actual shipments of about 700 different lots of ore, and taking testimony from the shippers. The nature of this work was admittedly one-sided in that it solicited grievances against the smelters. The committee has done a vast amount of work in analyzing the settlements rendered by the ore purchasers and in endeavoring to establish correlation between figures appearing at great variance. O. R. Whitaker, the mining engineer appointed to handle the technical features of the investigation, in proceeding with his inquiries, is being granted most courteous and helpful assistance by the smelters. It is his purpose to go into the costs, efficiencies and charges of the smelting practices and the prevalent bases of payment for the metals. It is believed he will complete these investigations by Sept. 1. When he is ready to report, it is planned that the experts and metallurgists of the smelting companies will be given opportunities to testify before the committee and thus to place the corporations' version officially on record.

SALT LAKE CITY—Aug. 4

Report of Surveyor General, I. C. Thoreson, for Utah, shows 836.860 acres to have been surveyed during fiscal year. Up to June 30, 1916, there had been surveyed 33,254.661 acres, with 20,294,828 acres in the state still remaining to be surveyed. Total acreage of Utah would therefore be about 54.386.375. Large force at present is in the field—1 double party, 3 single parties, 5 surveyors, and 36 assistants. In the mineral survey department 79 surveys were received and 267 locations. Thirty-one surveys and 108 locations were returned for correction. There were approved 44 surveys and 115 locations. Average cost per location was $19.99. June 30 1917, there were pending 57 surveys and 222 locations.

Oil Shales from Utah and neighboring states are being made the subject of experimentation at the University of Utah, with a view to extracting tar, oil, gas and other products. Samples of about five tons each coming from eastern Utah, the promontory section near Ogden, and from Elko, Nev., will furnish material for experiments. The shale will be distilled in a retort built on the campus after model of retorts successfully used in Scotland for same purpose. The heavy tars will first be thrown down, then petroleum, oil and gasoline, the oil, gas and nitrate products remaining uncondensed. These products will be used for fractional distillation, and many products are expected—all grades of oil, ammonia, paraffin, etc. The gas obtained from retort will be returned back into the retort and used in heating for further distillation—to take place of coal and cut down expense.

WALLACE, IDAHO—Aug. 4

Federal Troops Will Guard the mines and mills of the Coeur d'Alene district. This was the decision of Governor Moses Alexander after a visit to this city the first of the week and conferring with representatives of the mining companies and particularly upon representations made by Harry L. Day. The governor came here to investigate the I. W. W. situation and he found that there was no necessity for soldiers for general guard purposes, the local authorities with support of citizens who have organized for the purpose being equal to any probable emergency. With respect to the mines and mills, however, Mr. Day pointed out that the mining companies were already maintaining guards to protect their property, and inasmuch as they had entered into an agreement to furnish one-sixth of the lead required by the government, it was felt that the government should relieve them to the extent of furnishing soldiers for guard duty, both as a matter of fairness to the companies and to afford greater security. The governor was favorably impresed with this view and agreed to take the matter up at once with the war department.

CALUMET, MICH.—Aug. 3

The Labor Situation in the Lake Superior copper camp seems to be clearer right now than at any time in the past 4 or 5 months and with common labor for underground work more plentiful than in some time. A great many men have been coming in of late and the employment agencies have been instructed by all employing companies here to be careful to pick only good men, who are not affiliated in any way with the notorious I. W. W. organization which has been attempting to stir up strife between employees and employers here and in the Lake Superior iron mining camps. A few of this class of men have slipped in, of course, but in general they have been quickly found out and have been let go. Few have remained in the district. The organization again of the Citizens' Alliance, the pledge of which is strictly anti-I. W. W., has perhaps done more to clear up the situation than any other happening. More than 90%, for instance, of the employees of the Calumet & Hecla and its 10 or more subsidiary and associated companies, both mining and milling corporations, have joined the Alliance, and signed its pledge. The members are making it uncomfortable in the district for the I. W. W. agitators and followers with the result that the copper camp has had no trouble such as that being experienced about Ironwood and Bessemer in the iron districts. Furthermore, many of the employees of these companies have associated themselves in the "home guard" units here or have enlisted in the new Michigan Troops, a state protective military association. Practically all I. W. W. agitation has died out and the strike threatened by the few members remaining in the district for last Monday and a week ago last Monday absolutely failed to materialize. Not a man refused to go into the mines. The mining companies, furthermore, have been assured by committees of men of the latter's satisfaction with wages and working conditions. Governor Sleeper, while here, assured the men and the companies full and complete protection and stated that no labor or other disturbances would be countenanced by the state.

PHOENIX, ARIZ.—Aug. 2

Workmen Must Be Paid at Once, on being discharged or on quitting work voluntarily in Arizona, the state supreme court having affirmed a decision of the Yavapai County Superior Court in this matter. The act when passed was understood to have reference particularly to strike conditions. The case in point was that of a workman for the Arizona Power Co., who would not wait five days till the regular payday. Defense was made that the workman had entered into a contract with the corporation that included recognition of a semi-monthly payday.

JOPLIN, MO.—Aug. 4

First Important Sale in the New Lawton-Waco field, northwest of Joplin was recently recorded. L. P. Buchanan, of Joplin, who sold a one-fifth interest in the Blue Mound mine at Baxter last winter for $100,000, some time ago took an option on a lease of the Nichols land north of Lawton, Kan., from T. F. Coyne, of Webb City. The consideration was $50,000. Last week Buchanan announced that he had resold the lease to E. A. Wiltsee and New York associates for $100,000. Considerable drilling has been done by Buchanan on the tract, and rich cuttings have been shown. The tract adjoins that of the High Five Mining Co., where some of the richest holes ever brought in in the history of the district have been recorded in recent weeks. The new owners of the lease have purchased a mill in the Carterville camp and will move it immediately to the tract and fully develop the property.

Independent Lead Smeltery with a capacity of 500 tons of lead ore per week, is to be erected at some point near Quapaw or Picher, Okla., in the near future by the Ontario Smelting Co. Options have been taken on three different proposed sites and the problem of deciding which is the best is the only thing holding back actual building operations. Much of the material has been ordered, and the building force is being organized. It is expected the plant will be completed within 90 days. It will be built of brick and steel and will be modernly equipped. R. A. Farnham will have charge of plans and construction, and the plant will cost approximately $150,000. Frank E. Maulson, of Toronto, Can., will, with his associates, hold one-half the $25,000 stock, and the remainder will go to C. V. Jones, of Joplin. Mr. Jones is vice president of the Blue Mound Mining Co., which is headed by William Kenefick, of Kansas City, but Jones says Kenefick is not interested in this smelting project. The proposition is looked upon with favor by lead-ore producers, as they believe it will improve the local market. The plant will be about the size of the Eagle-Picher Lead Co.'s plant at Galena. Officers of the Ontario Smelting Co. are: C. V. Jones, president and treasurer; A. W. Thurman, vice president and Miss Catherine Scott, secretary. All live at Joplin.

WASHINGTON—Aug. 4

Occurrence of Manganese being studied by the Geological Survey, is entering a more intensive phase. G. W. Stose and F. J. Katz, Survey geologists, have left Washington to make physiographic and geologic study along the west slope of the Blue Ridge mountains between Vesuvius and Front Royal, Va. They will point out areas most likely to contain manganese deposits and which are most worthy of prospecting. They will be joined later by other Survey geologists. The special investigation of manganese is not to be confined to Virginia. J. B. Umpleby will proceed at once to Leadville and Silver City to investigate the manganese deposits in those localities. J. T. Pardee will study the appearance of manganese in the Butte district. R. W. Stone assigned to investigation work in the State of Washington. E. L. Jones, Jr., is en route to the Southwest where he will make a general inspection of manganese deposits in Arizona and other states in that section. Manganese occurrence in the region east of the Allegheny Mountains has been studied by certain members of the Geological Survey and some important geological conclusions have been reached. It has been shown fairly conclusively that most of the manganese ore was laid down under several types of structural associations during stages of planation of the region. During these stages manganese, originally disseminated through the Cambrian limestones and the lower Cambrian quartzite, was carried to favorable sites of deposition. There is also good reason for the belief that limestones or possibly some other rocks at higher stratigraphic horizons have also yielded deposits of ore during the same stages of planation. The exact stages of the physiographic cycle have not yet been determined fully and at least one unknown quantity is yet to be ascertained as to the conditions under which the residium accumulated. As far as investigations have proceeded, it appears probable that most of the deposits are related to one group of planation. Further studies of the problem requiring the services of experienced Appalachian stratigraphers and physiographers now are being conducted by the Geological Survey. Due to the fact that manganese deposits are almost invariably close to the surface, and to the fact that relatively little equipment is necessary for its mining, the government's specialists are taking a much more hopeful view of the domestic manganese situation. In fact some of them go so far as to say that the needs of the country can be met if the necessity should arise. The deposits are small but by the dissemination of knowledge as to their occurrence, greatly increased supplies are likely to continue to be produced since the deposits are readily available and the simplest kind of sorting, picking and washing machinery can be used to advantage. There are some deposits sufficiently extensive to permit the use of steam shovels.

TORONTO—Aug. 4

Lignite Briquette Plant to be established by the Canadian government will be at Estevan, Saskatchewan. The government has appropriated $250,000 for the manufacture of fuel briquettes from the lignite coal of Saskatchewan. If the proposed process can be made commercially successful it will be an important step in solving the fuel problem for western Canada.

Mining Prohibited at Rickard, the new gold camp, owing to the fact that the surface rights are controlled by the Abitibi Pulp & Paper Co., which is constructing a large dam at Twin Falls. This, when completed, will flood a considerable area in the immediate vicinity of the recent gold discovery. Applications for mining claims in the district affected have been refused until some arrangement can be made that will secure the Abitibi company from having to make good any damages occasioned by flooding. This will probably be effected at an early date.

Manitoba Mining Retarded and investment has been discouraged by the provision of the Federal mining law, under which title to mining lands under Federal jurisdiction is given by lease only. Prior to 1914 the law provided for a grant in fee simple of mineral claims upon applicant proving 5 years work thereon. It is asserted that this puts Manitoba mining claim owners in an unfavorable position for attracting capital, as compared with Ontario and British Columbia, where a fee simple title can be obtained. Mining men are petitioning the Federal government for reversion to the former law, under which mining titles may be given in fee simple.

The Mining News

ALASKA

STRIKE at Kennecott Copper Corporations mines, which began on June 16, reported ended satisfactorily to company and men returning to work. Production for July was 3,848,000 lb., compared with 5,848,000 lb. in June.

MOTHER LODE COPPER MINES CO. (McCarthy)—Bought the Kennecott's small experimental mill and will haul same from Kennecott, 16 miles, to its millsite. The 500-kw. power plant is to be completed this month.

ADMIRALTY-ALASKA GOLD MINING (Funter)—Constructing 2000-ft. power pipe line under 700-ft. head to secure several thousand horsepower. Installed 12-drill compressor and expect another 10-drill one shortly. Also to have 25 drills working in tunnel by autumn. Contemplating 1000-ton reduction plant to be built next spring. Company has 52 gold quartz claims.

ARKANSAS

SHIPMENTS from state's zinc and lead fields for July amounted to but 60 cars. However, production was larger than this, but uninviting price caused many to hold ore. J. C. Shepherd Mining Co., with mines at Rush, Buffalo and Pindall, continued biggest producer. Shipments from various districts as follows: Rush, 2,104,000 lb.; Pindall, 1,052,950 lb.; Gilbert, 376,000 lb.; Zinc, 478,760 lb.; and Ponca, 210,000 lb. One or two small "Arkansas" mills completed during month. Much interest shown by operators in dry-concentration mill being built near Yellville.

Newton County

ALLIED (Ponca)—Purchased Eleventh Hour mine, developed by J. Vancil, of Joplin, and associates. Produced 40 cars of ore last year. Charles E. Crawford, of Pettigrew, Okla., president.

Searcy County

BALD HILL (St. Joe)—Holding 750 tons silicate of zinc for better prices.

TOMAHAWK (St. Joe)—Small furnace completed. Only operating copper mine in state.

BIG HURRICANE (Pindall)—Two mills operating on property. One, regular Joplin type, other ball mill and slime tables. Chats from slime plant now being run through the third time for good recovery. Ore is carbonate of zinc.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—Company's report for second quarter ended June 30 shows development amounting to 5763 ft. New orebody, high-grade copper-lead-silver ore opened on Iron Prince claim in intermediate level from 214-ft. raise. Exposed for 36 ft. Small ore showings on 400 and 500-ft. levels, and ore body encountered on 600-ft. level in Leo claim.

Gila County

SIERRA ANCHA DISTRICT, 50 miles northwest of Globe, disturbed by uprising of Apache Indians who are reported on the warpath. Two largest asbestos mines suspended operations. Also said that forest fires were being started in vicinity of mines. Two I. W. W. organizers have been active among the force of 150 Mexicans and Indians employed. Posse left Globe in automobiles for Rice, Ariz., where they will obtain horses for ride to the mines to subdue the uprising.

MIAMI COPPER (Miami)—Production for June amounted to 5,349,000 lb. of copper, but since no further production made. Mediation under way between miners and officials but nothing definite resulted.

Mohave County

PAYROLL (Chloride) — Superintendent H. M. Henning is sending 30 tons lead-zinc ore daily to Steffy custom mill. Just finished new road to the mill. Chappell Brothers' truck hauling five tons each trip; makes six round trips daily.

Pima County

COMOBABI (Tucson)—Walter Harvey Weed, consulting engineer for Magnate Copper company recently made examination of Comobabi mine. Located midway between Magnate and New Cornelia mines at Ajo, 53 miles west of Tucson.

Yavapai County

ARKANSAS & ARIZONA (Jerome)—Drilling campaign discontinued on account of excessive cost, until conditions become more favorable for development work.

UNITED VERDE EXTENSIOIN (Jerome)—Directors' report states that no new developments of importance occurred. Ore extraction for April, 11,419 tons yielding 6,203,992 lb. copper; May, 7663 tons yielding 3,851,393 lb. copper; June, 8997 tons yielding 3,956,157 lb. May and June output curtailed by 10-day strike. Car shortage also reduced June output. New shaft and tunnel making fair progress. Course of tunnel changed to keep extension inside company's property throughout entire length. Length will be greater but development of unproven ground belonging to company considered more advantageous.

CALIFORNIA

Amador County

KENNEDY MINING AND MILLING CO. (Jackson)—The 100-stamp mill and chlorination plant in operation and no change has been made or contemplated. Zeila mine owned by the same company situated about 2 miles south of the Kennedy has not been reopened since its purchase by this company and no flotation plant has been installed or contemplated.

Calaveras County.

CALAVERAS COPPER (Copperopolis)—Has installed steam shovel to load dump ore for flotation mill. New vertical shaft being sunk on North Keystone group. Discovery shaft reached No. 9 level.

Contra Costa County

PACIFIC ELECTRO-METAL CO. (Bay Point)—Metallurgical plant to be constructed under supervision of Lindgren & Co. of San Francisco to cost about $50,000. Buildings will be of reinforced concrete.

Mono County

PITTSBURG-LIBERTY (Masonic)—Said to be in shipping class again, under leasing operations of Conway & Fredericks. New vein recently disclosed in prospecting beyond barren ground where the early-day miners quit.

Nevada County

WISCONSIN GRAVEL (Grass Valley)—New electric hoist and rotary blower to be installed.

COLUMBIA (Ormonde)—Mill being doubled in capacity by installation of 10 stamps. New electric hoist to be installed and aerial bucket-tramway connecting German and Ocean Star mines. Ocean Star shaft sunk to 300-ft. point disclosing good ore.

ALLISON RANCH (Grass Valley)—Ten stamps of new mill tested on July 17 were satisfactory. Other 10 stamps started following day. Remainder of surface and underground installations completed. Mine unwatered to 500-ft. point and development proceeding on 300- and 400-ft. levels.

Plumas County

REILLY (Seneca)—Lloyd Groover is hauling ore with "jitney" train made up of Ford engine installed on truck arranged to drive forward or backward, to which are hitched wagons for carrying ore.

IRON DYKE (Taylorsville)—Tunnel now in 1200 ft. from portal. Development produced 70 tons shipping ore of high grade; 25 men employed. W. W. Adams, superintendent.

Sierra County

HILO (Downieville)—Rich cleanup made from last year's gravel; work resumed taking out gravel for next spring's washing. Bernhardt Bros., owners and operators.

WINKEYE (Howland Flat)—This and Fillmore and Miners' Home gravel mines have full crews working in good ground.

OXFORD (Downieville)—A $500 pocket of free gold and sulphurets extracted by Casserly and Hertz who have surface lease.

GOLD BLUFF-OXFORD (Downieville)—Twenty stamps started on test run from drift on 90-ft. level. F. Meinecke, in charge.

IRONSIDES (Downieville)—Milling resumed on quartz from winter's underground work. Geo. Gruss of San Francisco in charge.

MONTE CARLO (Downieville)—Large body of gravel recently opened, paying 50 cts. per carload, has gradually increased to $10 and continues growing richer. Adjoins Downieville serpentine belt. A. Lavezzola and associates, owners and operators.

MOHAWK (Downieville)—While prospecting old gravel channel another bonanza quartz strike made on Allegheny-Downieville serpentine belt. Seven employes of The Union Oil Co. are owners. John N. Cubit, in charge.

CITY OF SIX (Downieville)—On serpentine belt, former high grade producer, under option to Hodgkinson & Henderson of Los Angeles. Contract let for 200 ft. of tunnel and upraise to tap old shaft which yielded bonanza ore. J. R. Mackay, contractor.

COLORADO

Boulder County.

TEXAS (Ward)—Development work resumed.

NATIONAL TUNGSTEN MINING CO. (Ward)—New milling plant will be completed within few weeks. Mine has been steady producer.

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—Ferro-tungsten unit of new refinery operating; acid plant will be completed soon. Crew of 60 to 70 men will be employed.

GOOD-FRIDAY (Boulder Falls)—Large tonnage, tungsten ore, developed; steady production made.

Gilpin County

PRIMOS CHEMICAL CO. (Empire)—Work resumed at molybdenum mine at Camp Boericke.

AMERICAN METALS CO. (Black Hawk)—Now receiving lead-zinc ores for custom treatment; business has increased considerably.

TWO-FORTY (Central City)—Mine plant electrified; 46-hp. motor being installed. Unwatering now under way. Mill overhauled and flotation installed.

LABOR SHORTAGE acute in district. Many small properties prevented from opening up this summer, and those now operating find difficulty in keeping sufficiently large crews.

Ouray County

PAYMASTER (Ironton)—Lease and bond secured. New shaft being sunk on ore chimney. Old shaft workings filled to first level with water.

San Juan County

ANTI-PERIODIC (Silverton)—Shipments of gold-silver-lead ore begun; worked entirely through adit levels. Milling- and shipping-grade ore developed.

HERMES (Silverton)—Development work on 5 tunnel levels carried on for 4 years and large tonnage developed. New tunnel being driven to cut veins 100 ft. below lowest adit; this tunnel now in 800 ft. and 500 ft. more to be driven. Ore consists of lead and zinc sulphides in vein 10 to 12 ft. wide. Mill will be built in near future. Wm. Callum is manager.

San Miguel County

SANTA CRUZ (Ophir)—Ore shipments being made to Durango.

BUTTERFLY (Ophir)—Lessees running 15 stamps of milling plant on ore from mine.

JUNTA GOLD MINING & MILLING CO. (Telluride)—Milling plant sold and dismantled.

FAVORITE (Ophir)—Shipping- and milling-grade ores being mined by lessees; milling-grade ore treated at Suffolk mill.

BLACK BEAR (Telluride)—Flotation making excellent recovery from tailings; ore treated at Smuggler-Union mill.

Summit County.

BLUE FLAG (Breckenridge)—Mine will be reopened. Equipment includes milling plant. Same company operating in Cripple Creek district.

BUNKER HILL (Breckenridge)—Three-foot vein opened in repairing workings of this Nigger Hill property. New development work will be done through Bunker Hill shaft.

MOLYBDENUM MILL may be built on Colorado & Southern railroad at Climax. Molybdenum prospects worked from time to time in this district; recently one company acquired control of group.

I. X. L. (Breckenridge)—Churn-drill hole being sunk to prospect ore body under "big stope" in main tunnel. Saw mill built to cut mine timbers and lumber for new milling plant. T. A. Brown, manager.

Teller County.

HIAWATHA (Cripple Creek)—Lessees shipping 1-oz. ore from 50-ft. level.

LITTLE MAY (Cripple Creek)—Denver leasing company on Little May and Little Blanche fractions mining milling-grade ore.

ROOSEVELT TUNNEL cut new water course in Old Ironsides claim of United Gold Mines Co., and flow increased to 6000 gal. per min.

CATHERINE GOLD MINING CO. (Cripple Creek)—Mine plant at Last Dollar mine, destroyed recently by fire, will be replaced as soon as insurance adjusted.

COPPER KING (Cripple Creek)—Lessees reopening Grouse Mountain mine, not worked for years, and developing on 50-ft. level.

ROSE NICOL (Cripple Creek)—Shaft now 60 ft. deep, will be sunk to meet raise from lateral driven in leased ground from 1000-ft. level of Portland No. 2 shaft. Property being worked by Camp Bird Mining, Leasing & Power Co.

FOREST QUEEN (Cripple Creek)—Under 5-yr. lease to Edwin Gaylord, of Denver. Main shaft being sunk from 650-ft. to 800-ft. level. Station enlarged at 650-ft. level, and underground hoist installed so production can be continued undisturbed on upper levels.

IDAHO

Shoshone County

AMAZON-DIXIE (Wallace)—Important strike announced on Amazon-Dixie, just across state line in Montana. Main tunnel proved ore shoot 600 ft. long of lead-zinc ore. Winze from this level sunk 250 ft., from which crosscut to vein showing ore of milling grade, mostly lead. Property largely owned by citizens of Cleveland, Ohio.

NATIONAL (Mullan)—Crosscut from shaft at depth of 535 ft. below main working tunnel cut vein, penetrated 35 ft., showing copper ore all the way of better grade than in upper workings. Management announces new strike insures profitable operation and will start 500-ton mill within 2 weeks. Shut down since Jan. 1. Former operations unprofitable, and theory that better ore would be found with depth seems to be confirmed.

GEORGIA

MATTHEWS IRON AND MINING CO. (Rome)—Leased 640-acre tract brown-ore land at Cartersville to assure full supply for mixing with Taylor Ridge red ore in furnace at Rome. Company purchased 100-ton stack at Rome, formerly operated by R. G. Peters Mining Co. and Silver Creek Furnace Co. Has sold entire output for last half of 1917 and considerable tonnage for first quarter, 1918. Furnace blown in about July 14.

MARYLAND

CHROME deposits in the Soldiers Delight serpentine area, northwest of Baltimore, are being reopened by J. H. Buxton, Jr., of Owings Mills, who has about 4500 acres under contract. The area embraces lode and placer chromite. Old lode mine being reopened and a new shaft sunk.

MICHIGAN

Copper

OSCEOLA (Osceola)—Ground south of only shaft in operation, No. 6, continues to produce good ore, which is found as high as 38 level; will be mined by raise and rock chute from 42d level.

CALUMET & HECLA (Calumet)—Average daily tonnage about 9,840, including 18 cars or about 855 tons Tamarack rock. American Bridge Co. pushing rapidly work on addition to leaching plant, one tank already in place.

HANCOCK (Hancock)—Output for June was 393,000 lb. copper, new high record. Three Whitcomb storage-battery locomotives will go to Quincy Shaft, No. 7. Two trolley locomotives to No. 2 Shaft, to operate on 49th and 53d levels.

NEW BALTIC (Baltic)—Now cutting station at 250 level of New Arcadian so levels of both mines will correspond. First level opened in New Arcadian; will start drifting soon. Good copper ore encountered in lode wherever cut by hanging-wall side of shaft, as occurred last week. Previously lode folded away, but gives signs of returning.

Iron

STRIKE of miners of the Gogebic range now ended. Miners returned to work according to agreement Aug. 6 at same wage and hours as formerly.

MINNESOTA

Mesabi Range

WHITESIDE (Buhl)—Shenango Furnace Co. is cleaning up its stockpile at this mine and running same through the drier.

CARSON LAKE (Hibbing)—Combined engine and boiler house being built. Shaft to be sunk as soon as machinery arrives.

MISSOURI

Joplin District

TRUSTEE (Joplin)—Has encountered fine run of lead ore, while sinking for water at mine northwest of Picher, Okla.

YELLOWSTONE (Joplin)—Sinking shaft to 160 ft. Planning to sink third shaft several hundred feet south of one now used.

FIRST NATIONAL (Quapaw, Okla)—Hand jigs installed ahead of mill, due to recent strike of rich ore in shaft at 109 ft. Mill will be built later.

THOMAS (Miami, Okla.)—Have water beaten at old broom-corn factory site, west of Treece, Kan., will start producing from 230 ft. level. Mill completed for some time.

BLUE MOUND (Baxter, Kan.)—Will start construction of second mill at once west of present plant. Originally intended to build mill east about half a mile, but this site will be used for No. 3 mill later.

DOMANDO (Miami, Okla.)—Mill, owned by Bethel Mining Co., completely destroyed by fire first of week. Thought to have started from electric wiring in derrick. Plant valued at $40,000, mostly insured. Will immediately rebuild.

PICHER MINES (Picher, Okla.)—Have fifth concentrating plant now in operation. For fiscal week ended Aug. 1, output was 948 tons. Manager A. E. Bendelari says with new plants now planned, company will be making 1500 tons weekly in few months.

MONTANA

Broadwater County

HYANTHA MINE (Winston)—Two carloads, silver-lead ore shipped to East Helena smeltery per week. Ore from 300-ft. level. Charles S. Muffly, superintendent.

HOGEM PLACERS (Townsend)—Flume at bedrock being put in to wash 50-ft. bank of gravel. Flume to be completed in next six weeks. Hydraulic operating in other ground near-by. J. H. Smith, superintendent.

Jefferson County

BLUE BIRD (Wickes)—Shipments of copper ore going out to west side smeltery.

ECONOMY COMPANY (East Helena)—Electric transformer of large capacity received at East Helena for Economy Mining Co. in Mitchell gulch.

BUTTE & CORBIN (Corbin)—Helena Scratch Gravel Co. working Butte & Corbin property at Corbin on lease. Developed by tunnel and winze. Ore, lead-silver.

MT. WASHINGTON (Wickes)—Shipping ore 12 ft. wide encountered in lower workings. Large tonnage of second-class ore to be treated in new mill. Ore, lead-silver.

Lewis and Clark County

WHITLATCH MINE (Helena)—Mill run of gold ore from 400 level made at Unionville.

PRODUCER (Helena)—Upraise in tunnel for air. Gold ore. Tunnel to be extended beyond diorite dike which cuts and faults vein.

ILLINOIS EXPLORATION CO. (Wolf Creek)—Extensive work under way. Developing copper claims by shaft. Propose to sink shaft 1000 feet.

Madison County

RUBY VALLEY (Virginia City)—Developing at this gold-silver-lead group. Electric equipment planned.

RAINE (Virginia City)—Exploration being continued on this low-grade group up Spring Gulch. Occasional high-grade pockets encountered.

THOMPSON (Virginia City)—Rich strike made on these claims in Barton Gulch. Gold, silver and lead. Will make shipment soon. W. O. Thompson, owner.

Silver Bow County

CZAR MINE (Butte)—When electric power line completed shaft will be sunk to 300 level and will start crosscut to vein. Preliminary exploration indicated presence of copper vein from 20 to 30 ft. wide. Mine fully equipped with hoist, compressor and all other facilities. Robert Green, Butte, manager.

NORTH BUTTE (Butte)—Report for quarter, ended June 30, shows production, 4,601,067 lb. copper, 224,074 oz. of silver and 304.67 oz., gold. Also 676,263 lb. of zinc and 4319 oz., silver recovered from zinc ore. Earnings amounted to $257,756. Surplus given as $5,855,541. Considerable development work carried on resulting in opening up of copper-silver orebodies. In eastern section, 4-compartment shaft started on Sarsfield claim about 150 ft. east of Continental fault. Will serve to develop oxidized ores lying along fault and explore eastward continuation of veins found productive in adjoining properties. Granite Mountain shaft damaged by recent fire being relined with steel and reinforced concrete from 1600 to 3000 level and timbers from surface to 1600 level will be cemented to make shaft fireproof. Will take 5 mos. to complete repairs during which time Speculator shaft will be utilized for hoisting ore.

NEVADA

Esmeralda County

FLORENCE GOLDFIELD MINING CO. (Goldfield)—Petition in bankruptcy filed some time ago. Appraisers appointed and surface improvements including mill ordered sold subject to court's confirmation. J. S. McBeth, attorney for corporation and A. D. Parker, president.

Lander County

COPPER CANYON (Battle Mountain)—Shipping about 50 tons per day. Shaft unwatered from 450-ft. to 590-ft. level, which is being unwatered now. Not extracting ore from either 530 or 590 level, as elsewhere reported. Has 3 veins; Virgin, Superior and Estes. First 2 worked 35 yrs. ago; Estes is discovery of present management and has produced all ore shipped amounting to $250,000 gross smelting returns. Shoot is 100 ft. long, stoping 20 ft. in width, high-grade copper with negligible gold and silver contents. Ore freighted 9 miles by teams and caterpillar to point on Nevada Central, then to Battle Mountain on narrow-gage railway, distant 20 miles. Thence to Salt Lake. Experimental concentrating work satisfactory so far. Using Layne & Bowler electric centrifugal pumps; power generated by three 50-hp. Fairbanks Morse oil engines.

Nye County

TONOPAH ORE PRODUCTION for week ended July 28 was 9079 tons valued at $158,882, comparing with 9290 tons for previous week. Producers were: Tonopah Belmont, 2744 tons; Tonopah Mining, 1800 tons; Tonopah Extension, 2380 tons; Jim Butler, 800 tons; West End, 987 tons; Rescue, 258 tons; North Star, 55 tons; Cash Boy, 55 tons.

TONOPAH EXTENSION (Tonopah)—Monthly report shows June receipts amount to $119,884 and current expenses were $81,080. Operating profit, $38,804.

JIM BUTLER (Tonopah)—Total net income for first six months $297,863. Receipts for ore shipped, $360,319; operating and administration expense, $112,800. Profit on stored silver sold, $47,772.

NEW MEXICO.

Grant County

CHINO (Hurley)—June copper output 7,193,262 lb., comparing with 6,984,457 lb. in May, and 7,243,432 lb. in June, last year.

JIM CROW-IMPERIAL MINES (Steeplerock)—Under bond and lease since November to W. P. Dunham of New York, and associates, J. W. Dunham, G. A. Whiteford and E. G. Thomas of Los Angeles, Calif. Sinking 200-ft. shaft to greater depth. Consists of group of eight patented claims; gold-silver producer. Have also optioned New Year's Gift group in same district; developing.

OREGON

Clackamas County

WILLIAM PIGOTT, of Seattle, Wash., head of the Pacific Coast Steel Co., has purchased the old blast-furnace plant of the Oregon Iron and Steel Co. on the Willamette River, at Oswego. Ores may be brought from Chile.

Josephine County

GOLD KING (Kerby)—After long idleness this gold mine has been relocated by T. P. Johnson and Mrs. J. M. Finch. Unwatering shaft. Development work was done few years ago but given up as it was unprofitable. With modern machinery new owners believe it can be put on paying basis. T. P. Johnston, manager.

SOUTH DAKOTA

Lawrence County

GLADIATOR (Deadwood)—Drifting on high-grade vertical. Property will be thoroughly developed.

REPUBLIC (Maitland)—Sol Burns and associates leased a part of property; making regular shipments to Trojan Mill.

HOMESTAKE (Lead)—Norberg hoist at B. and M. shaft placed in commission. Two 6-ton skips used in ore transportation: 1200 to 1400 tons handled in 8 hours.

TROJAN (Deadwood)—Leased greater part of Republic ground in Black Tail Gulch. Incline tunnel will be driven to quartzite and ore gained will be sent to company mill at Trojan.

Pennington County

BLACK HILLS TUNGSTEN (Hill City)—Work started on property. Concentrator will be overhauled and additions made. Custom ore will be handled in addition to that of company's.

TENNESSEE

SOUTHERN FERROALLOYS CO. (Chattanooga)—Leased Southern Steel Co.'s plant. Expect to produce ferrosilicon in November at rate of 3000 tons per year, using 3 electric furnaces now being installed. Power will be obtained from Tennessee Power Co.'s hydro-electric plant. Manufacture of other ferroalloys contemplated. Hall J. Kruesi, Chattanooga, president; Geo. L. Davison, general manager.

TEXAS

GRAPHITE deposit, being developed in Llano County by Ceylon E. Lyman, of 813 Lumber Exchange Building, Minneapolis, Minn., and associates, opened about two miles in length; eight veins opened in a width of 1500 ft.; additional veins indicated by recent development.

UTAH

Juab County

CHIEF CONSOLIDATED (Tintic)—Company's report for quarter ended June 30, shows development work amounted to a total for all mines of 3645 ft. of which drifts were 3437 ft.; raises, 139 ft. and winzes, 69 ft. Total shipments of ore was 16,353 dry tons of which lead ore amounted to 13,371 tons, dry ore, 2618 tons and zinc ore, 364 tons, yielding net after smelting and transportation charges, $420,987. Metal contents were 2481 oz. gold, 435,322 oz. silver, 2,652,113 lb. lead and 259,468 lb. zinc. Average gross value per ton, $40.40; smelting freight, sampling per ton, $14.65; average net value, $25.75; net profits after payment of all charges was $153,243.

Summit County

IOWA COPPER (Park City)—Shipping regularly and expect to continue until next winter. No. 1 incline down 200 ft. in ore on both sides. Spooner crosscut, 100 ft. from No. 1 incline, shaft sunk 50 ft., struck 2 ft. high grade copper ore at bottom on quartzite and lime contact. Installing air line, donkey engine and machine drills to complete developments. R. T. Kimball, secretary.

CANADA

Alberta

MANGANESE DEPOSITS in Cypress Hill mentioned in Journal last week are not being developed by Milton Hersey Co. as reported.

British Columbia

CANADA COPPER CORPORATION (Copper Mountain)—To continue development of Copper Mountain property and install 3000-ton mill. Stockholders meeting called to authorize issuance $2,500,000, 10-year, 6%, first-mortgage bonds and increase authorized amount of stock.

Manitoba.

GOLD PAN (Rice Lake)—Capt. I. L. Church, superintendent, and force of 10 men engaged in development with sufficient equipment to sink to 300-ft. level.

Ontario

ELLIOTT-KIRKLAND (Kirkland Lake)—Difficulty caused by flooding of mine overcome, work resumed.

WEST DOME CONSOLIDATED (Porcupine)—Official statement estimates ore reserves at 356,960 tons valued at $2,443,746.

KERR LAKE (Cobalt)—Output for June was 231,367 oz. silver, being new high record for recent years.

ANCHORITE (Porcupine)—Mining plant from Aguinico property being removed to this location. Being developed by Coniagas Co. of Cobalt.

ASSOCIATED GOLDFIELDS (Larder Lake)—Installed another turbine at Raven Falls power plant, bringing the capacity up to 1800 horsepower.

PORCUPINE CROWN (Porcupine)—Winze now at 900-ft. level will be put down to depth of 1100 ft. Mill re-treating old tailings from dump.

HOLLINGER CONSOLIDATED (Timmins)—Increased working force since wages of underground workers increased to flat rate of $4; employing 40 machines on development work which is proceeding at rate of about 5000 ft. per month. Abandoned practice of issuing monthly statements, but understood current production is larger than for some time past.

CUBA

DAVISON SULPHUR AND PHOSPHATE CO. (Cumanayagua, Santa Clara)—The Carlotta pyrite mine of this company, subsidiary of Davison Chemical Co., of Baltimore, Md., was examined recently by Pope Yeatman, who estimated a profit of $2.75 per ton on an annual production of 175,000 tons, under ante-bellum conditions, and a profit of $3.31 per ton with prices and freight rates estimated to prevail for several years after the war.

PERU

CERRO DE PASCO (La Fundicion)—July production of copper according to cable advices was 6,262,000 lb. comparing with 5,032,000 lb. in June.

AUSTRALASIA

QUEENSLAND GOLD PRODUCTION in May was 15,449 oz., or $319,331, compared with May, 1916, this was decrease of 12,348 oz. The large falling off due chiefly to strike at Mount Morgan this year. For 5 months ended May 31, total production was 71,126 oz., or $1,470,174; a decrease of 28,767 oz. from last year.

MT. LYELL MINING AND RY. CO (Mt. Lyell)—Directors report for half-year ended Mar. 31, shows ore mined 145,464 tons, comparing with 166,497 tons for the previous period; reduction due to shortage of labor. Only two furnaces operated. New converter plant about completed. Parcels of Lyell-Comstock ore and of flotation concentrates sent to Edwards Pyrites Works, Ballarat, for test by leaching process. Lake Margaret power installation to be extended to 800 hp., and the additional power is to be applied to an electrolytic zinc plant.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Aug.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
2	4.7556	80	40⅛	6	4.7556	80⅞	...
3	4.7556	80⅜	41	7	4.7556	81⅛	41⅛
4	4.7556	80⅜	41	8	4.7556	82⅛	41⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	26⅛		10⅛	10.50	8.40
2	@27	63⅛	@11	@10.90	@8.50
	26⅛		10⅛	10.50	8.40
3	@27	63⅛	@11	@10.90	@8.50
	26⅛		10⅛	10.50	8.40
4	@26⅛	63⅛	@11	@10.90	@8.50
	26⅛		10⅛	10.50	8.45
6	@26¼	63⅛	@11	@10.90	@8.50
	26		10⅛	10.50	8.45
7	@26⅛	63⅛	@11	@10.90	@8.50
	26		10⅛	10.50	8.45
8	@26⅛	63⅛	@11	@10.90	@8.50

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

LONDON

Aug.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
2	125	124½	137	247⅛	243½	30½	54
3	125	124½	137	246	242½	30½	54
4	...	...	...	...	...	...	...
6	125	124½	137	246	242½	30½	54
7	125	124½	137	246	242½	30½	54
8	125	124½	137	247	243½	30½	54

NEW YORK—Aug. 8

The metal markets this week were on the whole unsatisfactory to the producers, but they exhibited many interesting features. Copper was weak, while lead was stationary, but strong, and zinc was stationary, but dull.

Copper, Tin, Lead and Zinc

Copper—At the close of our last week of record, the general sentiment in the copper market was bullish and the market was apparently strong. However, it developed on the following day that an important producer, while very careful not to show its hand in this market, was freely offering in France copper for deliveries beginning with September, at 26⅜c., f.o.b. New York. Not succeeding in booking any business at that figure, it solicited counter-bids. Immediately afterward, the same producer, which had been nominally asking 29c., regular terms, in this market, stole a march on its competitors by inviting domestic manufacturers to discuss matters, which discussion was concluded by booking business with them at 27c., regular terms, which corresponds to 26⅜c., net cash, New York. In a market that was already stagnant and uncertain, owing to the mystery shrouding affairs in Washington, these maneuvers had the effect of destroying such incipient demand as there had been previously, whereupon sellers who had previously turned bullish tentatively reversed their position, offered copper at lower prices and made a few sales. In the latter part of the week August-September copper was offered at 26¼c., net cash, New York, and August-December at 26c., and some business was done on those terms. It is noteworthy that there is no longer any premium on prompt copper; also, that the backwardation on fourth-quarter delivery has contracted, and at present is not to exceed ¼c. per lb. This is considered to anticipate the strong statistical position that will probably be exhibited in copper a little later, owing to the recent curtailment of production at the mines.

Statements that further sales of copper have been made to the European Governments are without foundation. However, it appears that they want copper for early delivery.

Copper Sheets are quoted at 37c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire is quoted nominally at 33c. per lb., f.o.b. mill.

Tin—Prices were practically stationary throughout the week. Stagnation continued unabated. The market was exceedingly small. Quotations were practically nominal, representing transactions of only five or 10 tons per day. At the beginning of the week, Banka tin was quoted at 60c., and at the close at 60⅜c.

Lead—Some large business was done at prices ranging from 10⅛ to 11c., New York. Included in the sales were some for export, and more inquiries from abroad are pending. During the last two days there has been a substantial increase in domestic inquiries. The statistical position is very strong, especially for August delivery, owing to the curtailment of production in Missouri, while the Mexican output has been disappointing and has fallen off from the high figures reported not long ago. An easier situation is expected later, in anticipation whereof October-December lead is offered in round lots at 10c.

The situation in the mining district of southeastern Missouri is improving. A force of 300 Federal troops is now in the district, the commanding officer is handling the situation with great good sense and foreigners are gradually returning to work. The St. Joseph Lead company has kept its smelting works in operation, but has been obliged to suspend its shipments of concentrates to other smelters.

A strike at the smeltery of the St. Louis Smelting and Refining Co., at Collinsville, Ill., put that plant out of commission on Aug. 4. However, on the same day, the Pennsylvania Smelting Co., of Pittsburgh, Penn., resumed smelting, the strike at its plant having been settled.

The U. S. Government has arranged with the Lead Committee for 25,000 tons of lead, August-October delivery, at 8c. per lb., the same price as for the July contract.

Zinc—Fairly large business was done, including some round lots for export. The bulk of the business was taken at 8.45c., St. Louis basis. The zinc market was very sluggish.

The New Jersey Zinc Co. has begun rolling sheet zinc at Palmerton, Penn.

The Zinc Committee has been requested to call for bids on 5750 tons of Grade C spelter (prime Western) for the War and Navy Departments, on basis of f.o.b. St. Louis, deliverable within the next 10 months. Bids must be in the hands of A. P. Cobb, secretary of the Zinc Committee, 55 Wall St., New York, by noon, Aug. 10, 1917. The Zinc Committee has been authorized by the Secretary of the Navy and the Secretary of War to accept the lowest prices based on carload lots.

Some producers expressed uncertainty about bidding on the Government's requisition, while others expressed disinclination to do so at all. It is probable, therefore, that some bids will go in at high prices that the bidder has no expectation of getting, the bids being made out of politeness. The producer who has a mine or the producer who has a large accumulation of unsold stock may be able to enter into a contract for delivery 10 months ahead, but the smelter who has to rely on the open ore market finds it difficult and hazardous to commit himself at present level.

The U. S. Geological Survey reported today that production of spelter in the United States during the first six months of 1917 was 364,000 short tons, compared with 351,000 short tons during the last half of 1916. About 35,000 retorts were reported idle on July 1. Stocks of spelter in hands of smelters on July 1, were 33,000 tons.

Besides the stocks in hands of smelters, there is believed to have been a large stock in warehouses in St. Louis and elsewhere. Such stocks are not included in the report of the Geological Survey.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market is weaker. Quotations seem to be nominal and there is no interest in the market. Offers are reported as low as 48 @ 50c. per lb. for No. 1 ingots at New York; futures slightly lower.

Antimony—The market was unchanged at 15@15¼c. for spot. If anything, the tone of the market was slightly easier, it being believed that the accumulation of stocks has not yet been fully liquidated. September shipments from China are quoted at 14½@15c., c.i.f., in bond.

Bismuth—Quoted at $3.50 per lb.

Cadmium—Quoted at $1.40 @ 1.60 per lb.

Cobalt—Quoted at $1.70 per lb.

Magnesium—Ingot is quoted at $2 per lb

Nickel—Steady at 50@55c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Stocks in New York continue light, and quotations are made here at $115. San Francisco reports by telegraph $110; market strong.

Gold, Silver and Platinum

Silver—The market has ruled strong in London with advancing tendency due to small offerings on a market bare of supplies. The demand for coinage from England and the Continent continues and the need of silver for commercial purposes as well as for the mint in India is pressing. China exchanges have also advanced, so the future of silver looks promising for higher prices.

Mexican dollars at New York Aug. 1, 61¼c.; 2, 61¼c.; 3, 62⅝c.; 4, 62⅝c.; 6, 62⅝c.; 7, 63¼c.

Platinum—Steady at $105.

Palladium—Strong at $115 @ 125.

The U. S. Geological Survey reports that the present stock of unmanufactured platinum in the United States is 45,000 oz., 70% of which is available for industrial use, this report being based on the recent inquiry in the industry. It is considered that this stock is large enough to meet the requirements of the necessary industry, but is not enough to permit the manufacture of platinum jewelry. The most important demands will be from the gasoline-motor builders and for telegraph and telephone extensions. Sulphuric-acid contact-process plants are well supplied.

Zinc and Lead Ore Markets

Platteville, Wis., Aug. 4—Blende, basis 60% Zn, $70 for premium ore down to $65 for medium grade. Lead ore, basis 80% Pb, $112 per ton. Shipments reported for the week are 2916 tons of zinc ore, 63 tons of lead ore and 428 tons of sulphur ore. For the year to date the figures are: 83,906 tons of zinc ore, 3906 tons of lead ore and 17,335 tons of sulphur ore. Shipped during the week to separating plants, 3681 tons of zinc ore.

Joplin, Mo., Aug. 4—Blende, per ton, high $76.90; basis 60% Zn, premium $75; medium to low $70@65; calamine, per ton 40% Zn, $42@40; average selling price, all grades of zinc, $66.22 per ton.

Lead, high, $124.80; basis 80% Pb $120@110; average selling price all grades of lead, $118.16 per ton.

Shipments the week: Blende 8485 tons; calamine 717 tons; lead 1744 tons. Value, all ores the week, $815,320.

Shipment and production lower than in June. Hot weather and the draft are seriously affecting the situation. Some of the miners who were on the first call have refused to work since their names were published. These belong to the shifting population, and they may shift to some other locality.

Other Ores

Antimony Ore—Sales of high grade ore were reported at $2.25 per unit.

Chrome Ore—The quotation is unchanged at $1 per unit, f.o.b. California, for ore containing a minimum of 46%.

An important buyer of chrome ore has criticized our recent quotations, reporting that it has lately closed contracts for about 3000 tons at 55c. per unit from various producers. While occasional cars are bought by small users needing ore at high prices, this concern reported, under date of Aug. 1, that it knew of no sale in excess of about 70c. per unit for high grade ores. We believe that it is a fact, however, that buyers needing high-grade chrome ore have paid $1 per unit and that their demand is not yet satisfied.

Iron Ore—Prices, delivered lower Lake ports are for old-range bessemer, $5.95; old-range nonbessemer, $5.20; Mesabi bessemer, $5.70; and Mesabi nonbessemer, $5.05.

Manganese Ore—The market is easier, high grade metallurgical ore being quoted at $1.07 per unit, Pittsburgh and Chicago. Supplies have been stimulated and consumers are now said to be in a more comfortable position. It is reported that chemical ore, assaying 80% manganese dioxide, for shipment from Japan, is offered at $85 per ton, c.i.f., New York.

Molybdenum Ore—Small sales were reported at $2.15 per lb. of molybdenum sulphide in concentrates assaying 90%.

Pyrites—Spanish lump quoted at 15c. per unit on basis of 10s. ocean freight, buyer to pay war risk, excess freight and any duty. Ocean freights are 42s. 6d. from Huelva to southern ports, contracts having been made at that figure lately. This price is practically prohibitive; many inland fertilizer plants are turning to brimstone as a source of sulphur; some works may close if high ocean rates continue.

Tungsten Ore—The demand is still unsatisfied, high grade ore being sold without difficulty, and the market continues strong. We quote $25 for wolframite and $26 for scheelite, the prices varying considerably according to quality of ore. Present stocks of tungsten ore in New York are said to be less than 100 tons.

Iron Trade Review

PITTSBURGH—Aug. 7

Production of steel continues to be restricted by hot weather, to the extent of at least 15%, but there is no greater pressure for deliveries. Scarcely any new projects are being undertaken that would involve the consumption of steel but the ordinary manufacturing consumers of steel seem to expect approximately as heavy consumption in the future as in the past, provided the steel can be secured at a reasonable price.

Pig Iron—Transactions are few and involve very small tonnages, for early deliveries only. Consumption is not reduced, except on account of hot weather and that affects production of pig iron equally as much. The market remains quotable as formerly: Bessemer, $55; basic, $52; malleable and foundry, $53@55, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Asking prices are unchanged but there are no bids, and steel could hardly be sold except at much below asking prices, which remain $95@100 for billets and $105@110 for sheet bars.

Ferroalloys

Ferromanganese—The market is a shade easier on all positions, at $375@400 for prompt and second half and $350@375 for first half, delivered.

Coke

Connellsville—The market has continued to stiffen, on account of both car and labor shortage, spot being now quotable at $12.50@13.50 for furnace and at $13.50@14.50 for foundry, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Aug. 7
Alaska Gold M	5
Alaska Juneau	3⅞
Am.Sm.& Ref.,com.	103¾
Am. Sm. & Ref., pf.	114
Am. Sm. Sec., pf., A	98¼
Am. Sm. Sec., pf. B	91¼
Am. Zinc	25
Am. Zinc, pf.	59
Anaconda	77⅛
Batopilas Min.	1
Bethlehem Steel	127½
Bethlehem Steel, pf.	115
Butte & Superior	38½
Cerro de Pasco	34⅛
Chile Cop.	20
Chino	55½
Colo.Fuel & Iron	50⅛
Crucible Steel	84¼
Dome Mines	10
Federal M. & S.	26⅛
Federal M. & S., pf.	53⅛
Great Nor., ore ctf.	34⅞
Greene Cananea	42⅛
Gulf States Steel	116
Homestake	101
Inspiration Con.	57⅛
International Nickel	40
Kennecott	44⅛
Lackawanna Steel	93
Miami Copper	39
Nat'l Lead, com.	55½
National Lead, pf.	105
Nev. Consol.	23½
Ontario Min.	5⅛
Quicksilver	1⅛
Quicksilver, pf.	1⅛
Ray Con.	27⅛
Republic I.&S.,com.	92½
Republic I. & S., pf.	103⅛
Sloss-Sheffield	55⅛
Tennessee C. & C.	18⅛
U. S. Steel, com.	126⅛
U. S. Steel, pf.	118
Utah Copper	106⅛
Va. Iron C. & C.	69½

N. Y. CURB†	Aug. 7
Big Ledge	1⅛
Butte & N. Y.	1⅛
Butte C. & Z.	8⅛
Caledonia	.69
Calumet & Jerome	1 1/16
Can. Cop. Corpn.	2⅛
Carlisle	4
Cashboy	.07
Con. Ariz. Sm.	2 3/16
Con. Coppermines	8⅛
Con. Nev.-Utah	.06
Emma Con.	1 1/16
Ferber	‡.60
First Nat. Cop.	2⅛
Goldfield Con.	.58
Goldfield Merger	.05
Greenmonster	1
Hecla Min.	8⅛
Howe Sound	5⅛
Jerome Verde	1 1/16
Kerr Lake	5⅛
Magma	.52
Majestic	.40
McKinley-Dar-Sa.	.51
Milford	1⅛
Mohican	1/16
Mother Lode	.38
N. Y. & Hond.	14
Nipissing Mines	7⅛
Ohio Cop.	1 1/16
Ray Hercules	3⅛
Richmond	.55
Rochester Mines	.54
St. Joseph Lead	20
Standard S. L.	1/16
Stewart	1/16
Success	.30
Tonopah	6⅛
Tonopah Ex.	2⅛
Tribullion	.25
Troy Arizona	.19
United Cop.	.50
United Verde Ext.	37⅛
United Zinc	4⅛
Utica Mines	.21
White Knob, pf.	1⅛
Yukon Gold	2

SAN FRAN.*	Aug. 7
Alta	.03
Andes	.11
Best & Belcher	.03
Bullion	.02
Caledonia	.09
Challenge Con.	.01
Confidence	.05
Con. Virginia	.23
Gould & Curry	‡.02
Hale & Norcross	.01
Jacket-Cr. Pt.	.09
Mexican	.10
Occidental	.60
Ophir	.12
Overman	.01
Savage	.07
Seg Belcher	‡.01
Sierra Nevada	.08
Union Con.	.14
Utah Con.	.01
Belmont	4.40
Jim Butler	.80
MacNamara	.11
Midway	.10
Mont.-Tonopah	.19
North Star	.10
Rescue Eula	.17
West End Con.	.60
Atlanta	.11
Booth	.07
Comb. Frac.	.04
D'field Daisy	.03
Florence	.16
Jumbo Extension	.23
Kewanas	.13
Nevada Hills	.20
Nevada Packard	.31
Round Mountain	.36
Silver Pick	.10
White Caps	1.17½
Big Jim	.69
United Eastern	4.10

BOSTON EXCH.*	Aug. 7
Adventure	2
Ahmeek	.99
Algomah	.50
Allouez	63
Ariz. Com., ctfs.	12⅛
Arnold	25
Bonanza	.21
Butte-Balaklava	.55
Calumet & Ariz.	79½
Calumet & Hecla	545
Centennial	17
Copper Range	61⅛
Daly West	1⅛
Davis-Daly	5⅛
East Butte	11⅛
Franklin	6
Granby	81
Hancock	14⅛
Hedley	16
Helvetia	.25
Indiana	2
Isle Royale	30
Keweenaw	2
Lake	10⅛
La Salle	3⅛
Mason Valley	7⅛
Mass	11⅛
Mayflower	2
Michigan	1⅛
Mohawk	80⅛
New Arcadian	3
New Idria	14
North Butte	18
North Lake	1
Ojibway	1⅛
Old Dominion	57⅛
Osceola	84¼
Quincy	86
St. Mary's M. L.	‡77
Santa Fe	1
Seneca	9
Shannon	7⅛
Shattuck-Ariz.	24⅛
So. Lake	3
So. Utah	.15
Superior	8
Superior & Bost.	4
Trinity	6⅛
Tuolumne	.87
U. S. Smelting	58
U. S. Smelt'g, pf.	49
Utah Apex	2 1/16
Utah Con.	16
Utah Metal	4
Victoria	3⅛
Winona	3
Wolverine	47
Wyandot	.40

BOSTON CURB*	Aug. 7
Alaska Mines Corp.	.62
Bingham Mines	12⅛
Boston Ely	1
Boston & Mont.	.73
Butte & Lon'n Dev.	.15
Calaveras	3⅛
Calumet-Corbin	.01
Chief Con.	2⅛
Cortez	.15
Crown Reserve	.26
Crystal Cop.	.93
Eagle & Blue Bell	2⅛
Houghton Copper	‡.95
Intermountain	1⅛
Iron Cap, Com.	15⅛
Iron Cap Cop., pf.	15⅛
Mexican Metals	.26
Mines of America	1⅛
Mojave Tungsten	.52
Nat. Zinc & Lead	.40
Nevada-Douglas	1⅛
New Baltic	1⅛
New Cornelia	18⅛
Oneco	‡.50
Pacific Mines	‡.30
Rex Cons.	.23

SALT LAKE*	Aug. 7
Bannack	.55
Big Four	.17
Black Jack	‡.06
Cardiff	5.50
Colorado Mining	.18
Daly-Judge	8.00
Empire Copper	1.30
Gold Chain	.18
Grand Central	.58
Grand Gulch	‡.19
Iron Blossom	.89
Lower Mammoth	.03
May Day	.06⅛
Moscow	.15
Prince Con.	1.02½
Silver-King Coal'n	2.97½
Silver King Con.	3.70
Sioux Con.	.21
So. Hecla	1.55
Uncle Sam	.20
Wilbert	.22
Yankee	.07⅛

TORONTO*	Aug. 7
Bailey	‡.03
Beaver Con.	.33
Buffalo Mines	1.00
Chambers Ferland	.13
Coniagas	3.50
Hargraves	.11⅛
La Rose	.45
Peterson Lake	10⅛
Right of Way	.05
Temiskaming	.32
Wettlaufer-Lor.	.05
Dome Exten.	.15
Dome Lake	.17
Foley O'Brien	.60
Hollinger	4.25
McIntyre	1.50
Newray	.66
Porcu. Crown	.38
Schumacher	.42
Teck-Hughes	.48
Vipond	.31
West Dome	.18

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Aug. 7
Cresson Con.	6.00
Doctor Jack Pot	.04½
Elkton Con.	.06½
El Paso	.25
Gold Sovereign	.04½
Golden Cycle	2.05½
Granite	.45
Isabella	.09½
Mary McKinney	.10
Portland	1.42
United Gold M.	.20½
Vindicator	.68

LONDON	July 26
Alaska Mexican	£0 10s 0d
Alaska Tre'dwell	0 15 0
Burma Corp.	4 1 10½
Cam & Motor	0 8 6
Camp Bird	0 6 6
El Oro	0 9 6
Esperanza	0 9 0
Mexican Mines	4 7 6
Nechi, pfd.	0 12 6
Oroville	0 15 9
Santa Gert'dis.	0 10 6
Tomboy	0 18 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
August	47.163	66.083	.....	22.780	31.498	.....
September	48.680	68.515	.....	23.591	32.584	.....
October	49.385	67.855	.....	23.925	32.361	.....
November	51.714	71.604	.....	25.094	34.192	.....
December	54.971	75.765	.....	26.373	36.410	.....
Year	49.684	65.661	.....	23.675	31.315	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	2).962	112.432	130.000	137.455	142.0.0
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120	.....	110.283	.....	126.304	.....
Sept.	26.855	.....	113.905	.....	134.071	.....
Oct.	27.193	.....	122.750	.....	142.523	.....
Nov.	30.625	.....	134.659	.....	155.432	.....
Dec.	31.890	.....	145.316	.....	162.842	.....
Year	27.202	.....	116.059	.....	138.281	.....

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.570	168.357	242.181
August	38.565	.....	169.870	.....
September	38.830	.....	171.345	.....
October	41.241	.....	179.307	.....
November	44.109	.....	186.932	.....
December	42.635	.....	183.368	.....
Av year	43.480	.....	182.096	.....

Lead	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11 123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	.....	6.088	.....	29.734	.....
September	6.810	.....	6.699	.....	30.786	.....
October	7.000	.....	6.898	.....	30.716	.....
November	7.042	.....	6.945	.....	30.500	.....
December	7.513	.....	7.405	.....	30.500	.....
Year	6.853	.....	6.777	.....	31.359	.....

Spelter	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
Jan	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar	16.846	10.300	16.676	10.130	90.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug.	8.730	.....	8.560	.....	51.587	.....
Sept	8.990	.....	8.820	.....	52.095	.....
Oct	9.829	.....	9.659	.....	54.159	.....
Nov.	11.592	.....	11.422	.....	56.023	.....
Dec.	10.665	.....	10.495	.....	55.842	.....
Year	12.804	.....	12.634	.....	72.071	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	.....	18.95	.....	19.22	.....
September	22.88	.....	19.58	.....	19.53	.....
October	24.61	.....	21.26	.....	21.51	.....
November	30.07	.....	28.18	.....	26.55	.....
December	35.16	.....	30.95	.....	30.79	.....
Year	$23.88	.....	$20.98	.....	$21.15	.....

‡ As reported by W. P. Snyder & Co.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Price in cents per pound:

Blue Annealed	Large Lots, Pittsburgh	St. Louis	Chicago	San Francisco	New York Aug. 6, 1917	New York One Yr. Ago
No. 10	8.25	9.55	9.50	10.50	10.00	4.25
No. 12	8.65	9.60	9.55	10.55	10.05	4.30
No. 14	8.65	9.65	9.60	10.60	10.10	4.35
Black						
Nos. 18 and 20	8.55	9.65	9.30	10.80	10.30	3.45
Nos. 22 and 24	8.60	9.70	9.35	10.83	10.35	3.50
No. 26	8.65	9.75	9.40	10.88	10.40	3.55
No. 28	8.75	9.85	9.50	10.98	10.50	3.65
Galvanized						
No. 10	9.50	10.45	9.70	....	....	....
No. 12	9.60	10.45	9.70	12.15	....	4.50
No. 14	9.75	10.45	9.70	12.15	12.10	4.50
Nos. 18 and 20	9.90	10.65	10.00	12.45	12.40	4.60
Nos. 22 and 24	10.30	10.80	10.15	12.62	12.55	4.55
No. 26	10.45	10.95	10.20	12.77	12.70	....
No. 28	10.75	11.25	10.50	13.06	13.00	5.00

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Aug. 4, 1917	Pittsburgh One Year Ago	Chicago Aug. 4, 1917	Chicago One Year Ago
Standard bessemer rails	$60.00 to 80.00	$33.00	$38.00	$33.00
Standard openhearth rails	60.00 to 80.00	35.00	40.00	35.00
Light rails, 8 to 10 lb.	83.00*	50.00	68.00	43.00
Light rails, 12 to 14 lb.	82.00*	49.00	67.00	42.00
Light rails, 25 to 45 lb.	75.00*	47.00	65.00	40.00

*Demand for light rails active and mills are obtaining premiums. Rerolled rails as valuable as new.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Aug. 4, 1917	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝-in. and larger	$7.00	$2.65	$5.00	$5.75	$5.75
Track bolts	7.00	3.25	6.25	Premium	7.30
Standard section angle bars	4.00	2.00	4.00	Premium	4.65

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Pittsburgh	New York Aug. 4, 1917	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$4.50	$5.25	$2.50	$5.05	$5.00	$7.75	$6.00
Channels, 3 to 15 in.	4.50	5.25	2.50	5.05	5.00	7.75	6.00
Angles, 3 to 6 in., in. thick	4.50	5.25	2.50	5.05	5.00	7.75	6.25
Tees, 3 in. and larger	4.50	5.30	2.50	5.05	5.05	7.75	6.25
Plates	9.00	9.00	2.90	8.05	8.00	10.00	9.00

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Mill, Pittsburgh	Warehouse New York	Chicago	St. Louis	San Francisco	Dallas
¾ in. and larger	$5.25	$7.00	$5.50	$5.55	$6.65	$8.40

CONE HEAD BOILER

¾ in. and larger	5.35	7.10	5.60	5.65	6.75	8.50
⅝ and ⅞	5.50	7.25	5.75	5.80	6.90	8.65
½ and ⅝	5.85	7.60	6.10	6.15	7.25	9.00

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Cincinnati	St. Louis	Denver	Birmingham
Straight	$6.75	$7.00	$7.75	$6.50
Assorted	7.25	7.15	8.00	7.00

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York Aug. 4, 1917	New York One Year Ago	St. Louis	Chicago	San Francisco
Galvanized	10—2½%	25—2½%	10—2½%	10—2½%	15%
Bright	20—2½%	35—2½%	20—2½%	20—2½%	5%

SWEDISH (NORWAY) IRON—This material per 100 lb. sells as follows:

	Aug. 4, 1917	One Year Ago
New York	$14.00	$6.00
Cleveland	12.30	6.30
Chicago	12.00	5.25

In coils an advance of 50c. usually is charged:

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, as per basing card of July 2, 1917, for iron; May 1, for steel:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
¾ to 3	49%	35½%	¾ to 1½	33%	17%

LAP WELD

2	42%	29½%	2	26%	12%
2½ to 6	45%	32½%	2½ to 4	28%	15%
7 to 12	42%	28½%	4½ to 6	28%	15%
13 and 14	32½%	....	7 to 12	25%	12%
15	30%	....			

BUTT WELD, EXTRA STRONG PLAIN ENDS

¾ to 1½	47%	34½%	¾ to 1½	33%	18%
2 to 3	48%	48½%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	40%	28½%	2	27%	14%
2½ to 4	43%	31½%	2¼ to 4	29%	17%
4½ to 6	42%	30½%	4½ to 6	28%	16%
7 to 8	38%	24½%	7 to 8	20%	8%
9 to 12	33%	19½%	9 to 12	15%	3%

From warehouses at the places named the following discounts hold for steel pipe:

Black	New York	Chicago	St. Louis
¾ to 3 in. butt welded	38%	42.8%	34.27%
3½ to 6 in. lap welded	28%	38.8%	27.27%
7 to 12 in. lap welded	20%	35.8%	21.27%

Galvanized	New York	Chicago	St. Louis
¾ to 3 in. butt welded	22%	27.8%	19.27%
3½ to 6 in. lap welded	10%	24.8%	13.27%
7 to 12 in. lap welded	10%	20.8%	6.27%

Malleable fittings, Class B and C, from New York stock sell at 5 and 5% from list prices. Cast iron, standard sizes, 34 and 5%.

MISCELLANEOUS

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Denver
Pure steam-distilled pine oil	$0.50½	$0.80
Pure destructively distilled pine oil	.40	.46
Pine tar oil	.26	.38½
Crude turpentine	.37	.59
Hardwood creosote	.19½*	.50

*F.o.b. Cadillac, Mich.

SODIUM CYANIDE—New York price is 30c. per lb; Denver, 44 to 46c.

SODIUM SULPHIDE—In New York the price per pound is 3¾c. for concentrated, 2c. for crystals. The Denver price for concentrated is quoted at 8 to 9c. Concentrated comes in 500-lb. drums, the crystals in 400-lb. barrels.

ZINC DUST—New York price is 18c. per lb. in 1600-lb. barrel; Denver, 15 to 16c.

CALCIUM CARBIDE—Price f.o.b. cars at warehouse points east of Mississippi (except in Alabama, Georgia and Florida) is $82.50 for Cameo, $87.50 for Union. In territory between Mississippi River and the Rockies and in Alabama, Georgia and Florida, add $5; west of Rockies, add $10 to $15.

HOSE—

Fire

	50-Ft. Lengths
Underwriters' 2½-in.	65c. per ft.
Common, 2½-in.	40–10%

Air

	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0.55	$0.30	$0.25

Steam—Discounts from list

First grade... 30% Second grade... 30-5% Third grade... 40-10%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition ..... 50–10% Best grade 25%
Standard 40%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	50%	40%
Chicago	40—5%	35—10%
Birmingham	35%	35%
Denver	40%	45%

RAWHIDE LACING—40%.

MANILA ROPE—For rope smaller than ⅜-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft.; ½-in., 6; ⅝-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ⅜-in. and larger, in 1200-ft. coils:

Boston	$0.34	New Orleans	$0.31
New York	.33½	Seattle	.31½
Denver	.36	St. Paul	.31½
Kansas City	.31½		

PACKING—Below are prices each per pound in cities named:

Asbestos

		St. Louis	New York	Denver	Birmingham
Valve	Twisted plain, 25-lb. cartons	$1.25	$0.65@0.70	....	$1.50
	Twisted graphite, 25-lb. cartons	1.25	.90	$1.40	1.50
Stuffing Box	Braided plain, 25-lb. cartons	1.50	.80	.60	1.50
	Braided graphite, 25-lb. cartons	1.50	1.00	.60	1.50

Asbestos wick in balls, ¼, ½-, 1-, 25- and 50-lb. cartons, $0.65@0.70, New York; $1, Chicago.

Rubber asbestos, compressed sheet, medium grade about $0.80, New York; 45c., St. Louis; $1, Chicago.

STEAM

Following in 25- and 50-lb. cartons:

	New York	Denver	Birmingham	St. Louis
First grade	$0.83	$0.80	$1.00	$0.80
Second grade	.55	.60	.90	....

RUBBER AND DUCK

High grade	$0.50	....	....	$0.60
Cold water	.30	....	....	.40

PISTON

Asbestos, duck and rubber	$1.75	$0.80	$0.90	$1.50
Flax, first grade	.94	.60	.32	.75
Rubber and duck	.90	.60	.60	.60

RAILWAY TIES—For fair-size orders, the following prices per tie hold:

	Material	6 in. x 8 in. by 8 Ft.	7 in. x 9 in. by 8 Ft. 6 In.
New York	Yellow Pine	$1.06 to 1.11	$1.25
St. Louis	No. 1 White Oak	1.00	.75
Chicago	White Oak	.97	.82
San Francisco	Green	.77	1.01
San Francisco	Creosoted	1.20	1.62

GREASES—Prices are as follows in the following cities in cent sper pound for barrel lots:

	New York	Denver	Chicago	Birmingham	St. Louis
Cup	5 to 7	8	7½	6	10½
Fiber or sponge	5 to 7	15	7¾	6	5½
Transmission	5 to 7	15	6¼	6	6
Axle	3 to 7	5	5	3	4½
Gear	4 to 5	5	6½	6	10
Car journal	6½ to 7¼	20	6	..	3½ to 7½

WIPING CLOTHS—In Cleveland the jobbers' price per 1000 is as follows:

13¼ x 13¼ ..... $35.00 13¼ x 20½ $45.00

In Chicago they sell at $30 to $33 per 1000.

COTTON WASTE—The following prices are in cents per pound:

	New York Aug. 4, 1917	New York One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	12.50	15.00	13.00 to 15.00
Colored mixed	8.50 to 12.00	9.00	13.00	10.00 to 12.00

LINSEED OIL—These prices are per gallon:

	New York Aug. 4, 1917	New York One Year Ago	Cleveland Aug. 4, 1917	Cleveland One Year Ago	Chicago Aug. 4, 1917	Chicago One Year Ago
Raw in barrels	$1.16	$0.71	$1.20	$0.73	$1.17	$0.73
5-gal. cans	1.26	.81	1.35	.83	1.27	.83

WHITE AND RED LEAD in 500-lb. lots sell as follows in cents per pound:

	Red Aug. 4, 1917 Dry	Red Aug. 4, 1917 In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Aug. 4, 1917 Dry and In Oil	White 7 Yr. Ago Dry and In Oil
100-lb. keg	13.25	13.50	10.50	11.00	13.00	10.50
25- and 50-lb. kegs	13.50	13.50	10.75	11.25	13.25	10.75
12½-lb. keg	13.75	14.00	11.00	11.50	13.50	11.00
1- to 5-lb. cans	15.25	15.50	12.50	12.50	15.50¼	12.50

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Aug. 4, 1917	New York One Year Ago	Cleveland Aug. 4, 1917	Cleveland One Year Ago	Chicago Aug. 4, 1917	Chicago One Year Ago
Hot pressed square	List	$2.00	$1.65	$2.75	$3.00	$3.25
Hot pressed hexagon	List	2.00	1.50	3.00	3.00	3.25
Cold punched square	List	1.50	1.40	2.50	1.75	3.00
Cold punched hexagon	List	2.00	1.40	3.00	2.25	3.50

Semifinished nuts sell at the following discounts from list price:

	Aug. 4, 1917	One Year Ago
New York	50%	50—10%
Cleveland	50%	60%
Chicago	50%	65%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
⅝ by 4 in. and smaller	30%	35—5%	25—5%
Larger and longer up to 1 in. by 30 in.	15%	20—5%	20—2½%

WROUGHT WASHERS—From warehouses at the places named the following amount isi deducted from list price:

New York ..... $5.00 Cleveland ..... $4.50 Chicago $4.50

For cast-iron washers the base price per 100 lb. is as follows:

New York ..... $2.25 Cleveland ..... $4.50 Chicago $3.50

EXPLOSIVES—Price per pound in small lots at cities named:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	Gelatin 80%	Black Powder*
New York	.....	$0.26½	$0.33½	.....	$2.35
Boston	.....	.....	.33¼	$0.40¾	....
Kansas City	$0.19	.25¼	.30¼	.36½	....
New Orleans	.20¼	.24¼	.29¼	.....	....
Seattle	.17½	.23¾	.30¾	.....	....
St. Paul	.19	.25¼	.32¼	.42¼	2.35
St. Louis	.15½	.21½	.29½	.34¾	1.95
Denver	.18	.24¼	.31¼	.41¼	....

*75%.

FUEL OIL—Price variable, depending upon stock. New York quotations not available owing to this fact. In Chicago and St. Louis the following prices are quote:

	Chicago	St. Louis
Domestic light, 22-26 Baume	7¾c.	8.5c.

Note—There is practically no fuel oil in Chicago at present time.

OILS—Price per 50-gal. bbl. is as follows:

City	Fuel	Black	Red Engine	Steam Cylinder	Gasoline
Seattle	$4.45	$6.25	$11.00	$21.00	$20.25
Denver	3.00	9.00	13.00	25.00	12.00
Los Angeles	1.20	5.00	10.50	25.00	10.00
St. Paul	3.00	5.50	11.00	17.50	10.05
Cincinnati	5.00	5.50	10.50	17.00	12.00
Boston	5.00	8.00	12.50	18.75	12.50
Kansas City	6.95	4.35	10.35	17.35	9.65

CONSTRUCTION MATERIALS

PREPARED ROOFINGS—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.15	$1.30	$1.45	$1.60	$1.75	$1.90
No. 2 grade	1.00	1.15	1.25	1.40	1.50	1.65

Asbestos asphalt saturated felt (14 lb. per square) costs $5.35 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.85 per roll in carload lots and $2.10 for smaller quantities.

Shingles, red and green slate finish, cost $4.75 per square in carloads, $5 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices per ton f.o.b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tar felt (14 lb. per square of 100 sq.ft.)	$59.00	$60.00
Tar pitch (in 400-lb. bbl.)	15.00	17.00
Asphalt pitch (in barrels)	29.00	30.50
Asphalt felt	60.00	62.00

CORRUGATED SHEETS—Price of corrugated sheets (2½-in. corrugations) per pound:

Gage		Mill, Pittsburgh	Cincinnati	Birmingham	St. Louis	Denver
18–20	Black	$0.0845	$18.00*	....	$0.092	....
28	Black	.087	5.75*	....	.094	$0.10
10	Galvanized	.0935	....	....	....	....
18–20	Galvanized	.0995	22.50*	$0.11	....	....
28	Galvanized	.1055	8.75*	.12	.113	.12

*Price per square of 100 sq.ft.

HOLLOW TILE—The price per 1000 in carload lots f.o.b. mine is as follows:

	4 x 12 x 12	8 x 12 x 12
Cincinnati	$68.80	$129.00
St. Louis	60.00	110.00
Denver, per ton	90.00	170.00
Birmingham	52.00	97.50

LUMBER—Price of yellow pine per M in carload lots:

	1-In. Rough, 10 In. x 16 Ft.	2-In. T. and G.	8 x 8 In. x 20 Ft.
Denver	$32.00	$42.00	$36.00
St. Louis	31.50	28.00	36.50
Birmingham	24.00	26.00	22.00

Lumber—Price per M in carload lots:

	1-In. Rough, 10 In. x 16 Ft. and Under Y.P.	1-In. Rough, 10 In. x 16 Ft. and Under Fir	1-In. Rough, 10 In. x 16 Ft. and Under Hemlock	2-In. T. and G. 10 In. x 16 Ft. Y.P.	2-In. T. and G. 10 In. x 16 Ft. Fir
Kansas City	$44.00	$44.50	$43.00	$52.00	....
Seattle	18.50	18.50	18.50	18.50	$18.50
New Orleans	26.00	....	....	28.00	....
St. Paul	....	51.00	33.50	59.00	37.50

	8 x 8-In. x 20 Ft. and Under Y.P.	Fir	Hemlock	Spruce	12 x 12-In., 20 Ft. and Under Y.P.	Fir
Kansas City	$39.00	$35.00	$35.00	....	$45.00	$35.00
Seattle	18.50	18.50	18.50	$18.50	18.50	18.50
New Orleans	24.50	....	....	....	30.00	....
St. Paul	....	40.00	31.50	32.00	....	45.00

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Aug. 4, 1917	One Month Ago	One Year Ago
New York	$2.22	$2.22	$1.72
Jersey City	2.16	2.16	1.66
Boston	2.77	2.77	1.92
Chicago	2.31	2.31	1.81
Pittsburgh	2.31	2.31	1.81
Cleveland	2.44	2.44	1.94
Denver	2.39	2.39	...
Los Angeles	2.40	2.40	...